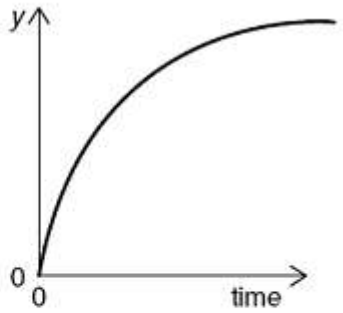
Questions compiled by Leong Yee Pak

3.1 Linear motion

Section A

****1 June 02 P1 Q6**

The graph relates to the motion of a falling body.



Which is a correct description of the graph?

A *y* is distance and air resistance is negligible

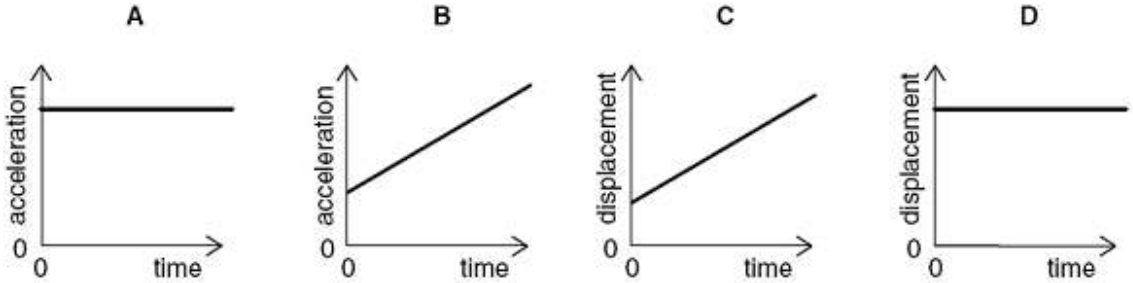
B *y* is distance and air resistance is not negligible

C *y* is speed and air resistance is negligible

D *y* is speed and air resistance is not negligible

***2 June 02 P1 Q7**

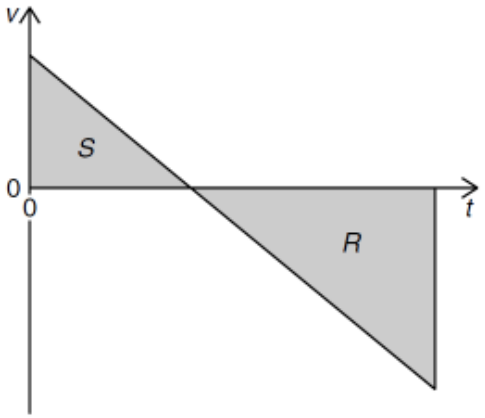
Which graph represents the motion of a car that is travelling along a straight road with a uniformly increasing speed?



****3 June 02 P1 Q8**

8 A stone is thrown upwards from the top of a cliff. After reaching its maximum height, it falls past the cliff-top and into the sea.

The graph shows how the vertical velocity v of the stone varies with time t after being thrown upwards. R and S are the magnitudes of the areas of the two triangles.

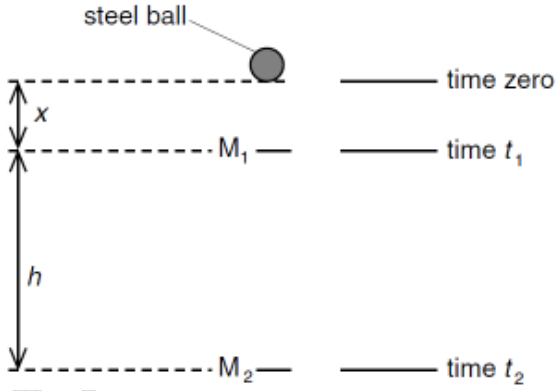


What is the height of the cliff-top above the sea?

A R **B** S **C** $R+S$ **D** $R-S$

****4 Nov 02 P1 Q9**

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



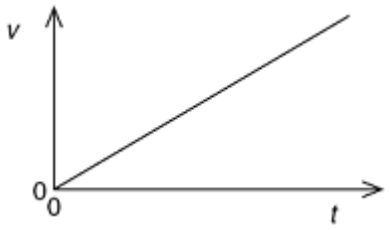
When a steel ball is released from rest from a point a distance x above M_1, it is found that the ball takes time t_1 to reach M_1 and time t_2 to reach M_2.

Which expression gives the acceleration of the ball?

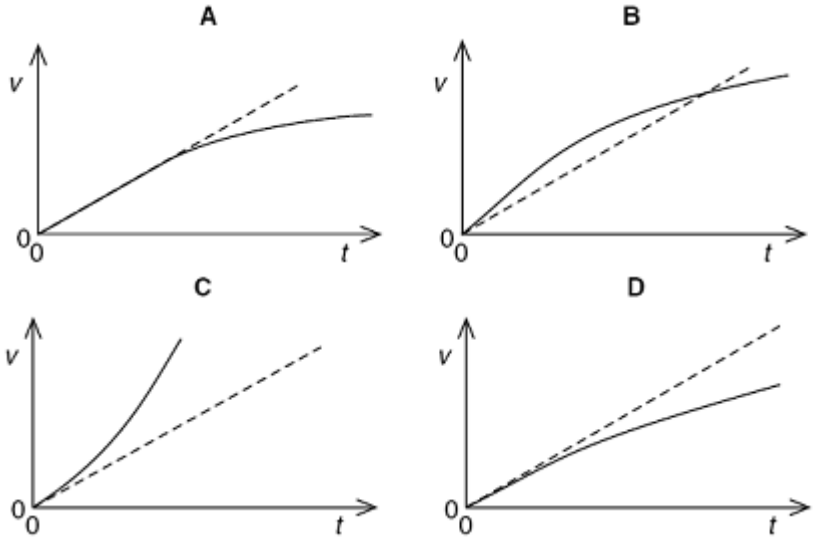
A $\frac{2h}{t_2^2}$ **B** $\frac{2h}{(t_2+t_1)}$ **C** $\frac{2h}{(t_2-t_1)^2}$ **D** $\frac{2h}{(t_2^2-t_1^2)}$

****5 Nov 02 P1 Q10**

A body falls from rest in a vacuum near the Earth's surface. The variation with time t of its speed v is shown below.

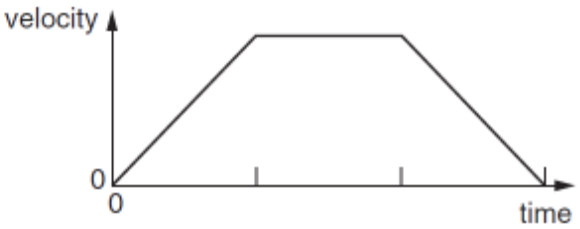


Which graph shows the variation with time t of the speed v of the same ball falling in air at the same place on Earth?



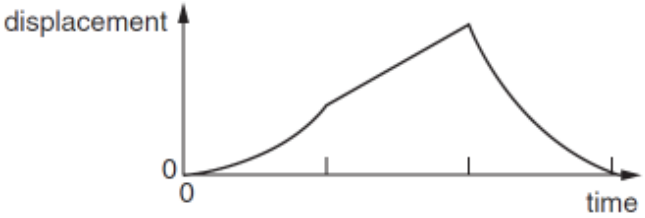
**6 June 03 June Q8

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

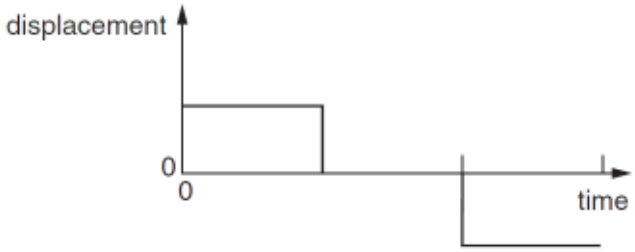


Which of the following is the corresponding graph of displacement against time?

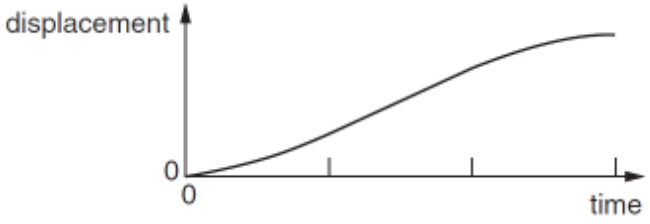
A

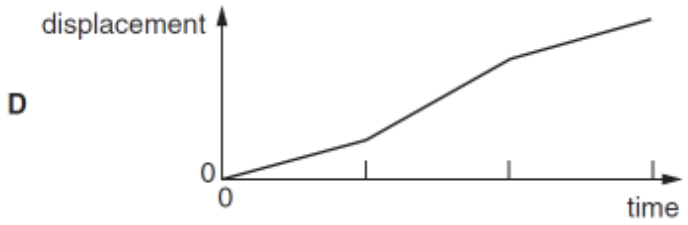


B

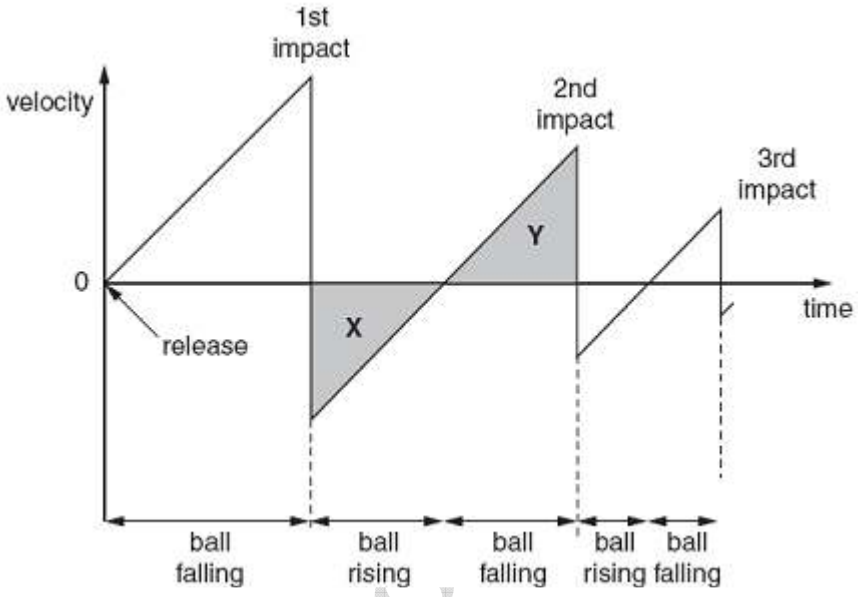


C





**7 June 03 P2 Q9



Areas **X** and **Y** are equal.

This is because

A the ball's acceleration is the same during its upward and downward motion.

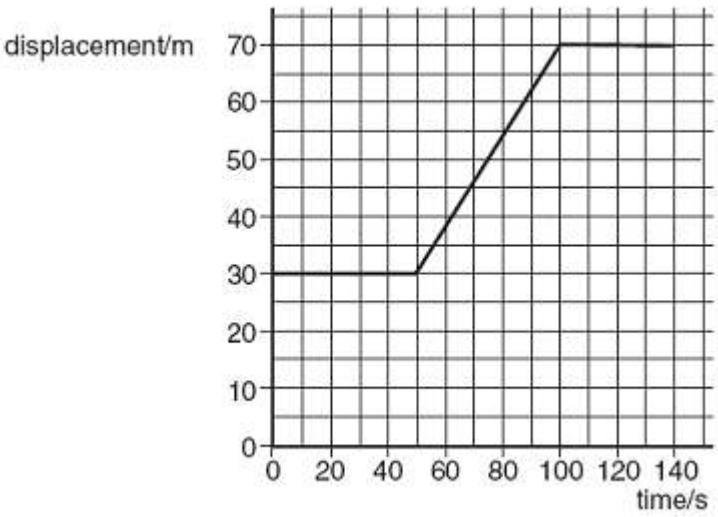
B the speed at which the ball leaves the surface after an impact is equal to the speed at which it returns to the surface for the next impact.

C for one impact, the speed at which the ball hits the surface equals the speed at which it leaves the surface.

D the ball rises and falls through the same distance between impacts.

**8 Nov 03 P1 Q7

A car at rest in a traffic queue moves forward in a straight line and then comes to rest again. The graph shows the variation with time of its displacement.



What is its speed while it is moving?

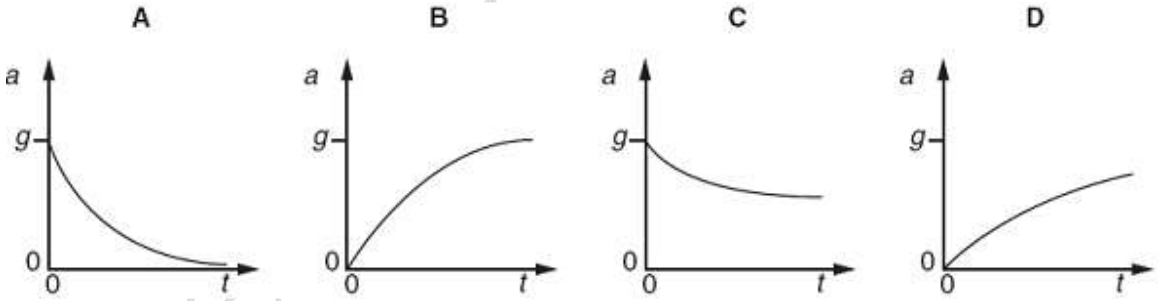
A $0.70\,m\,s^{-1}$ **B** $0.80\,m\,s^{-1}$ **C** $1.25\,m\,s^{-1}$ **D** $1.40\,m\,s^{-1}$

***9 Nov 03 P1 Q8**

An object is dropped from a great height and falls through air of uniform density.

The acceleration of free fall is *g*.

Which graph could show the variation with time *t* of the acceleration *a* of the object?



****10 June 04 P1 Q7**

A car is travelling with uniform acceleration along a straight road. The road has marker posts every 100 m. When the car passes one post, it has a speed of $10\,m\,s^{-1}$ and, when it passes the next one, its speed is $20\,m\,s^{-1}$.

What is the car's acceleration?

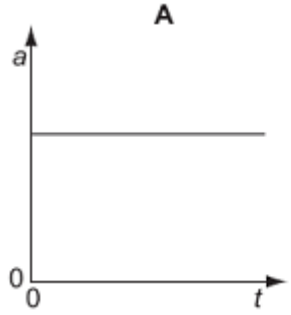
A $0.67\,m\,s^{-2}$ **B** $1.5\,m\,s^{-2}$ **C** $2.5\,m\,s^{-2}$ **D** $6.0\,m\,s^{-2}$

***11 June 04 P1Q8**

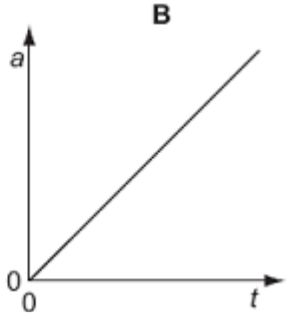
A tennis ball is released from rest at the top of a tall building.

Which graph best represents the variation with time *t* of the acceleration *a* of the ball as it falls, assuming that the effects of air resistance are appreciable?

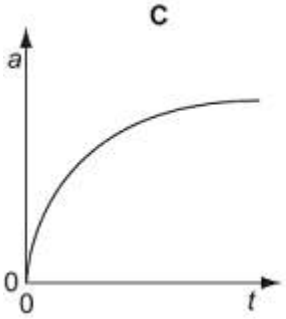
A



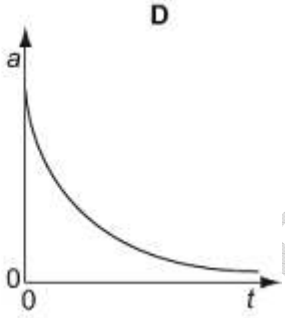
B



C

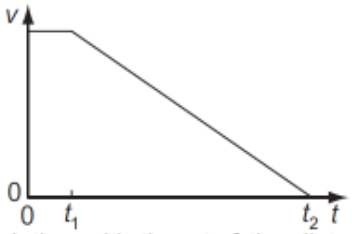


D



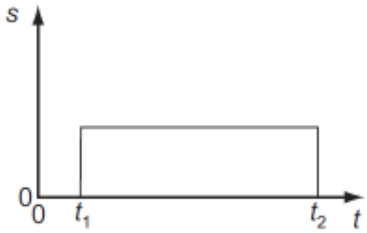
**12 Nov 04 P1 Q8

8 When a car driver sees a hazard ahead, she applies the brakes as soon as she can and brings the car to rest. The graph shows how the speed v of the car varies with time t after the hazard is seen.

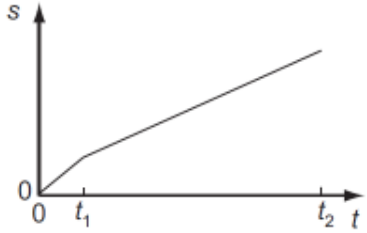


Which graph represents the variation with time t of the distance s travelled by the car after the hazard has been seen?

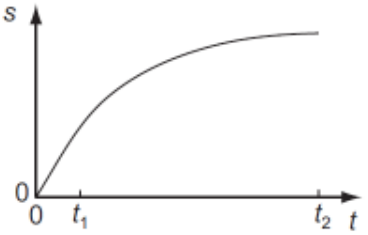
A



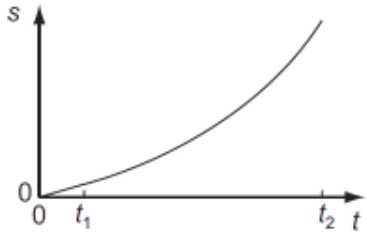
B



C



D



**13 Nov 04 P2 Q9

9 An object falls 10.0 m from rest before entering some water.

Assuming negligible air resistance, what is the time taken to reach the water and the speed with which the object reaches the water?

	time / ms	speed / $m s^{-1}$
A	1.02	10.0
B	1.02	14.0
C	1.43	10.0
D	1.43	14.0

*14 June 05 P1 Q6

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

**15 June 05 P1 Q7

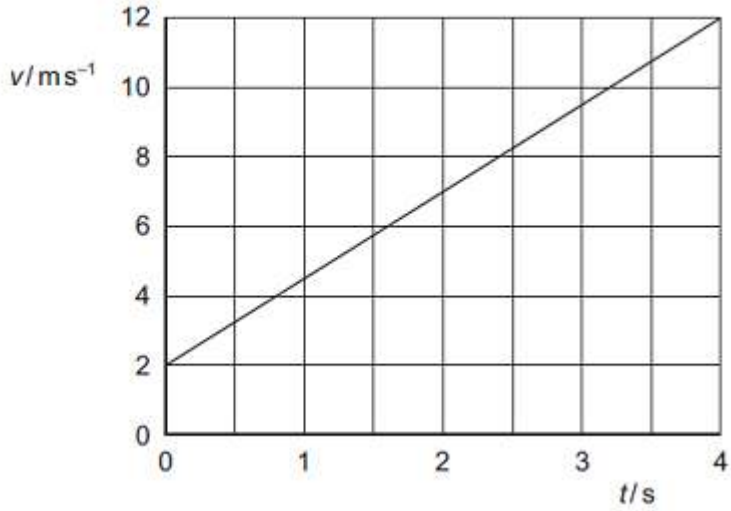
A boy throws a ball vertically upwards. It rises to a maximum height, where it is momentarily at rest, and falls back to his hands.

Which of the following gives the acceleration of the ball at various stages in its motion? Take vertically upwards as positive. Neglect air resistance.

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

**16 June 05 P1 Q8

The diagram shows a velocity-time graph for a car.



What is the distance travelled between time $t = 0$ and $t = 4$ s?

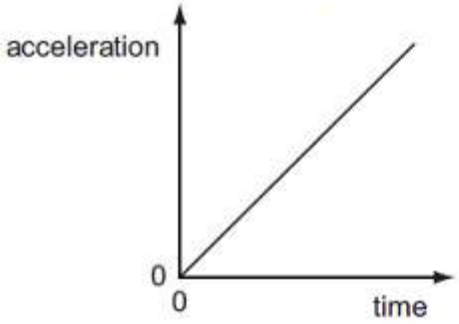
A 2.5 m **B** 3.0 m **C** 20 m **D** 28 m

*17 Nov 05 P1 Q6

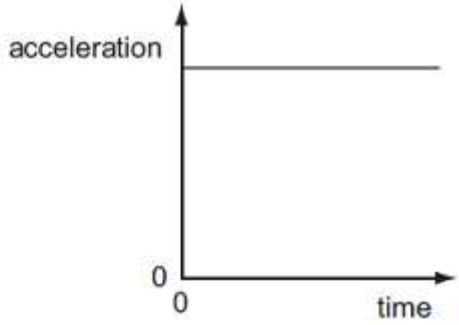
A football is dropped from the top of a tall building.

Which acceleration-time graph best represents the motion of the football through the air?

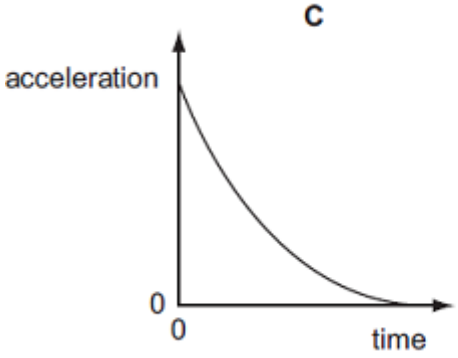
A



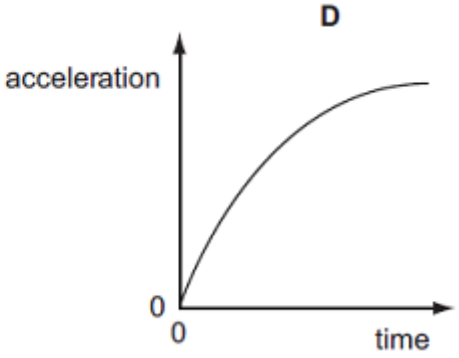
B



C

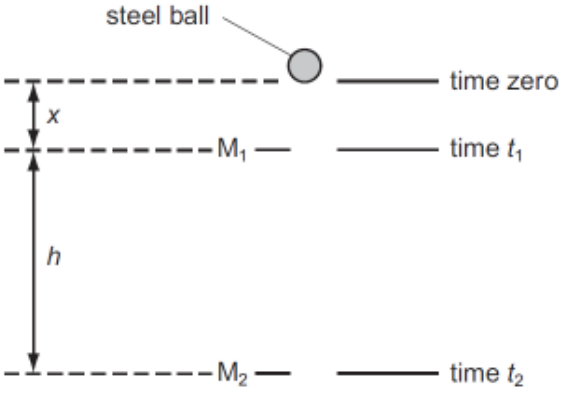


D



**18 Nov 05 P1 Q7

7 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.

Which expression gives the acceleration of the ball?

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

**19 June 06 P1 Q7

An experiment is done to measure the acceleration of free fall of a body from rest.

Which measurements are needed?

A the height of fall and the time of fall

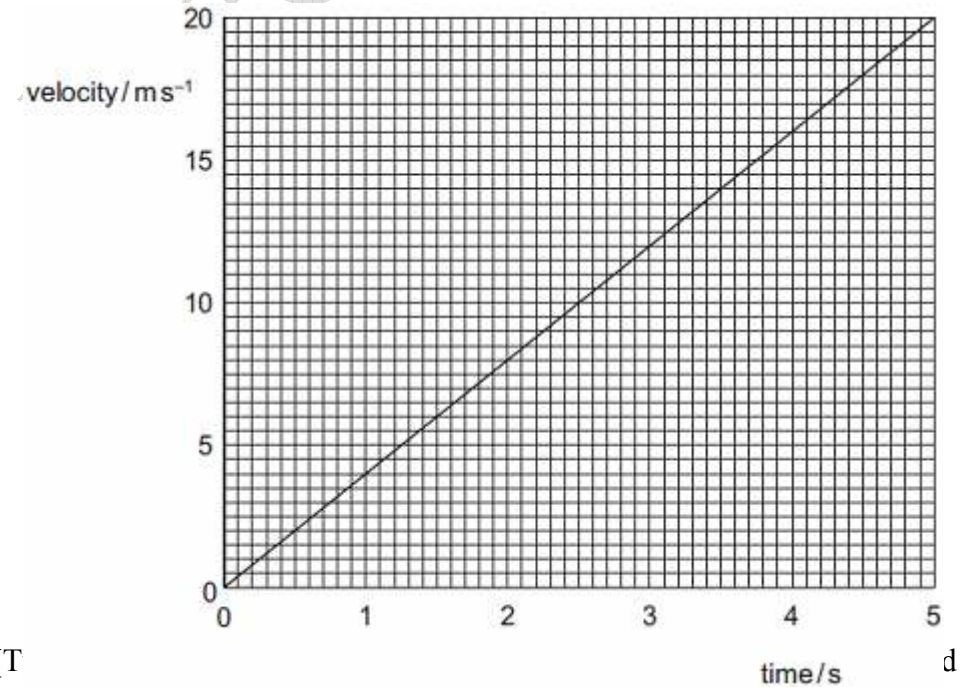
B the height of fall and the weight of the body

C the mass of the body and the height of fall

D the mass of the body and the time of fall

**20 June 06 P1 Q8

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



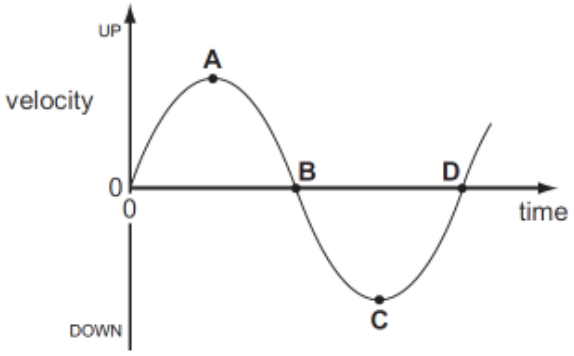
What is the distance travelled by the object in this time?

A 4 m **B** 20 m **C** 50 m **D** 100 m

*****21 June 06 P1 Q9**

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

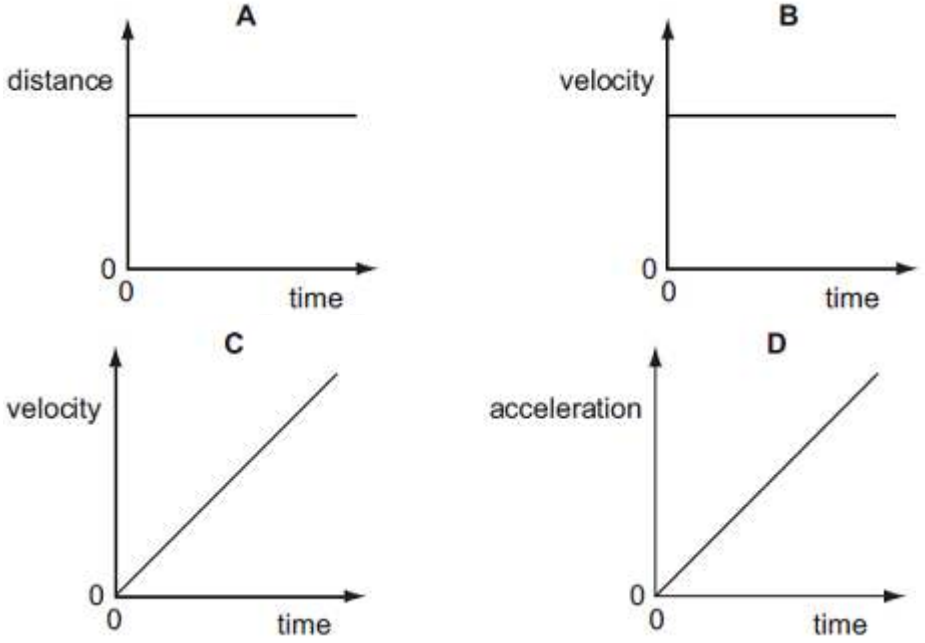
Which point represents the velocity of the mass when at the lowest point of its motion?



***22 Nov 06 P1 Q7**

A particle is moving in a straight line with uniform acceleration.

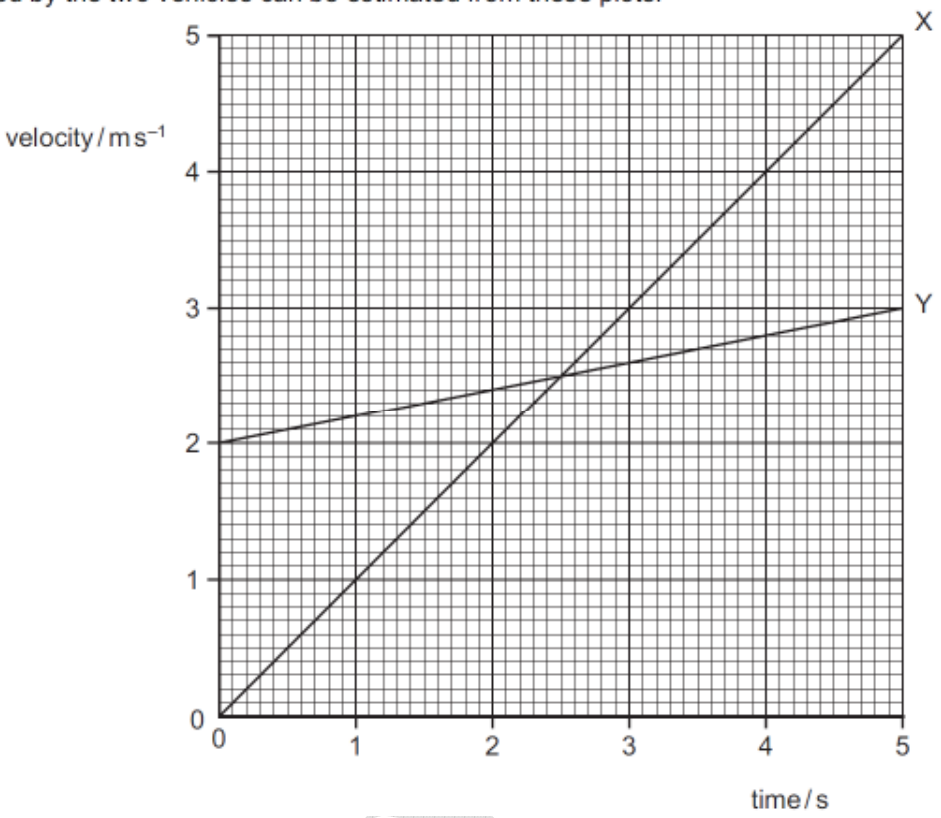
Which graph represents the motion of the particle?



.

**23 Nov 06 P1 Q8

8 The graph shows velocity-time plots for two vehicles X and Y. The accelerations and distances travelled by the two vehicles can be estimated from these plots.



Which statement is correct?

A The accelerations of X and Y are the same at 2.5 s.

B The initial acceleration of Y is greater than that of X.

C The distance travelled by X is greater than that travelled by Y in the 5 s period.

D The distances travelled by X and Y in the 5 s period are the same.

*24 June 07 P1 Q6

6 What gives the value of a body's acceleration?

A the area under its displacement-time graph

B the area under its velocity-time graph

C the gradient of its displacement-time graph

D the gradient of its velocity-time graph

***25 June 07 P1 Q8

8 A stone is dropped from the top of a tower of height 40 m. The stone falls from rest and air resistance is negligible.

What time is taken for the stone to fall the last 10 m to the ground?

A 0.38 s B 1.4 s C 2.5 s D 2.9 s

**26 Nov 07 P1 Q7

7 The symbol *g* represents the acceleration of free fall.

Which of these statements is correct?

A *g* is gravity.

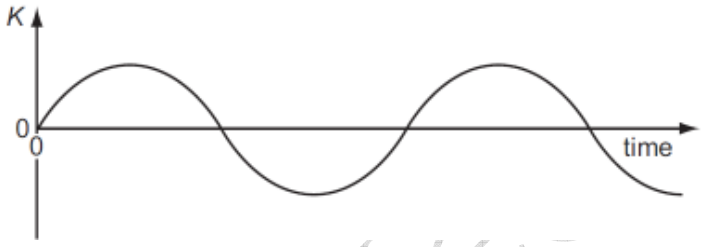
B *g* is reduced by air resistance.

C *g* is the ratio weight / mass.

D *g* is the weight of an object.

*27 Nov 07 P1 Q8

8 A particle moves along a straight line. A particular property *K* of the particle's motion is plotted against time.



At any time, the slope of the graph is the acceleration of the particle.

What is the property *K*?

A the displacement of the particle

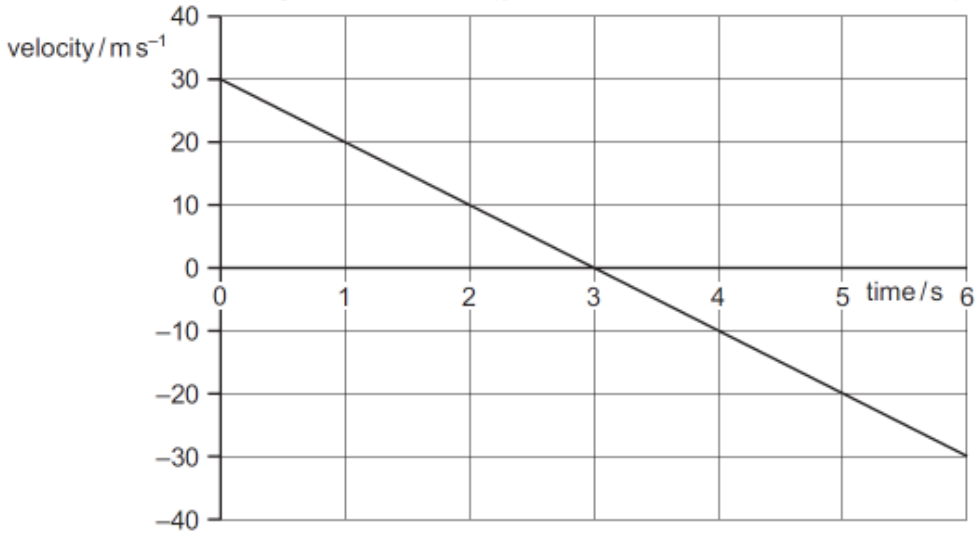
B the distance travelled by the particle

C the speed of the particle

D the velocity of the particle

***28 Nov 07 P1 Q9

9 A stone is thrown vertically upwards. A student plots the variation with time of its velocity.

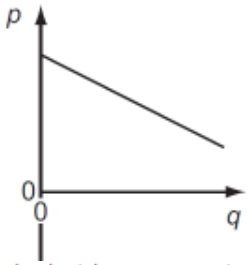


What is the vertical displacement of the stone from its starting point after 5 seconds?

A 20 m **B** 25 m **C** 45 m **D** 65 m

****29 Nov 07 P1 Q12**

12 The graph shows how a certain quantity *p* varies with another quantity *q* for a parachutist falling at terminal speed.



What are the quantities *p* and *q*, and what is represented by the magnitude of the gradient of the graph?

	quantity *p*	quantity *q*	magnitude of gradient
A	height	time	terminal speed
B	momentum	time	weight of parachutist
C	height	potential energy	mass of parachutist
D	velocity	time	acceleration of free fall

****30 June 08 P1 Q6**

6 An object accelerates in a direction that is always perpendicular to its motion.

What is the effect, if any, of the acceleration on the object's speed and direction?

	speed	direction
A	changes	changes
B	changes	constant
C	constant	changes
D	constant	constant

****31 June 08 P1 Q7**

7 The acceleration of free fall on a planet P is $\frac{1}{6}$ of the acceleration of free fall on Earth.

The mass of a body on planet P is 30 kg.

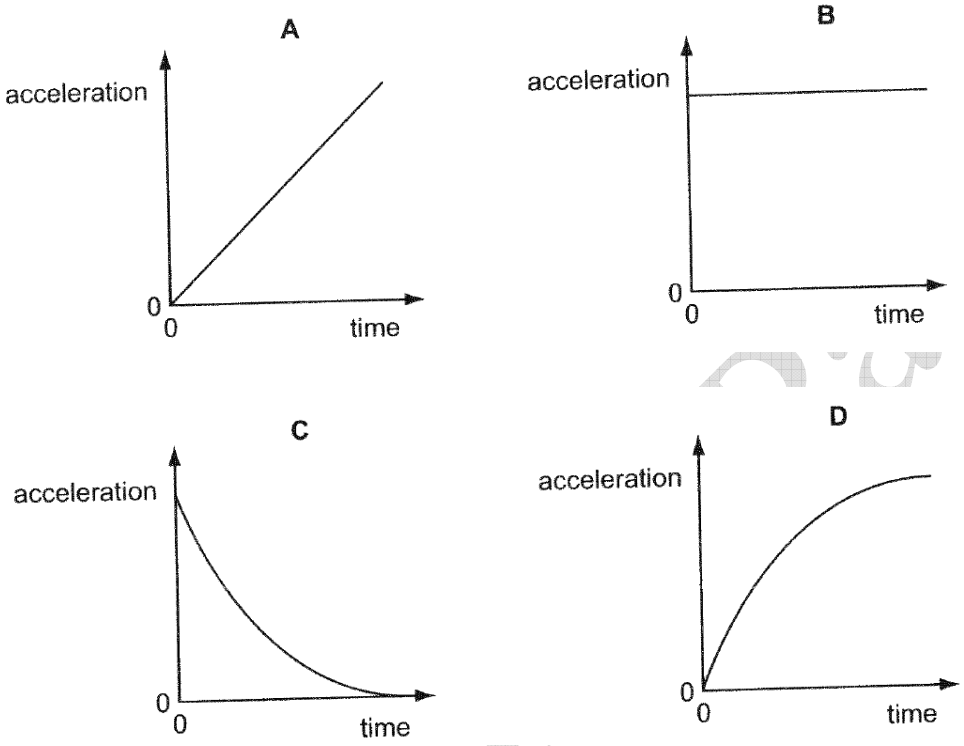
What is its weight on planet P?

A 4.9 N **B** 49 N **C** 180 N **D** 290 N

***32 June 08 P1 Q8**

8. A football is dropped from the top of a tall building.

Which acceleration-time graph best represents the motion to the football through the air?



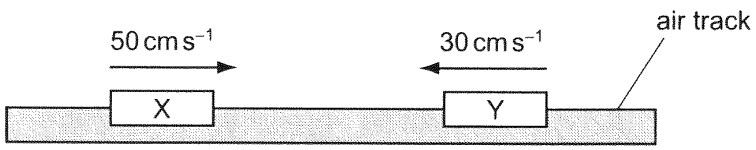
***33 June 08 P1 Q9**

Which is a statement of the principle of conservation of momentum?

A Momentum is the product of mass and velocity.
B Momentum is conserved only in elastic collisions.
C Momentum is conserved by all bodies in a cooision.
D Momentum is conserved providing no external forces act.

****34 June 08 P1 Q10**

10 Two equal masses X and Y are moving towards each other on a frictionless air track as shown. The masses make an elastic collision.

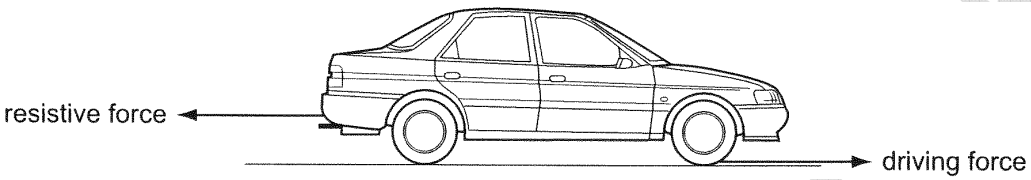


Which row gives possible velocities for the two masses after the collision?

	velocity of X	velocity of Y
A	zero	$20\,cm\,s^{-1}$ to the right
B	$10\,cm\,s^{-1}$ to the right	$10\,cm\,s^{-1}$ to the right
C	$20\,cm\,s^{-1}$ to the left	zero
D	$30\,cm\,s^{-1}$ to the left	$50\,cm\,s^{-1}$ to the right

****35 June 08 P1 Q11**

11 A car of mass 750 kg has a horizontal driving force of 2.0 kN acting on it. It has a forward horizontal acceleration of $2.0\,m\,s^{-2}$.



What is the resistive force acting horizontally?

A 0.5 kN **B** 1.5 kN **C** 2.0 kN **D** 3.5 kN

****36 June 08 P1 Q12**

12 A ball is falling at terminal speed in still air. The forces acting on the ball are upthrust, viscous drag and weight.

What is the order of increasing magnitude of these three forces?

A upthrust → viscous drag → weight

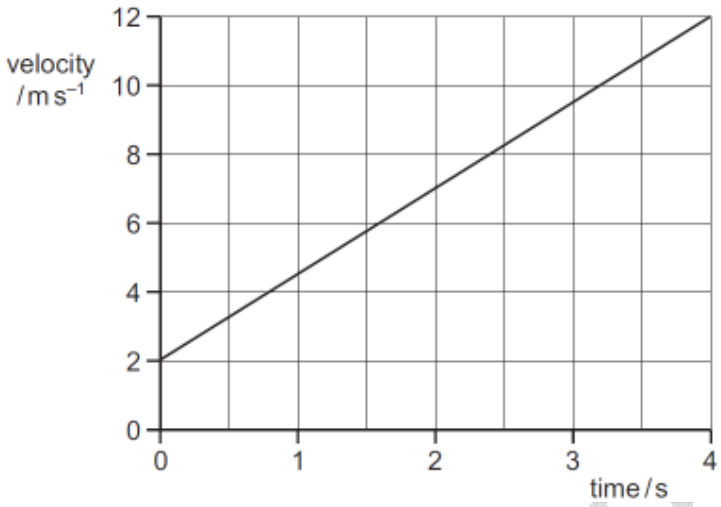
B viscous drag → upthrust → weight

C viscous drag → weight → upthrust

D weight → upthrust → viscous drag

****37 Nov 08 P1 Q6**

6 The diagram shows a velocity-time graph for a car.

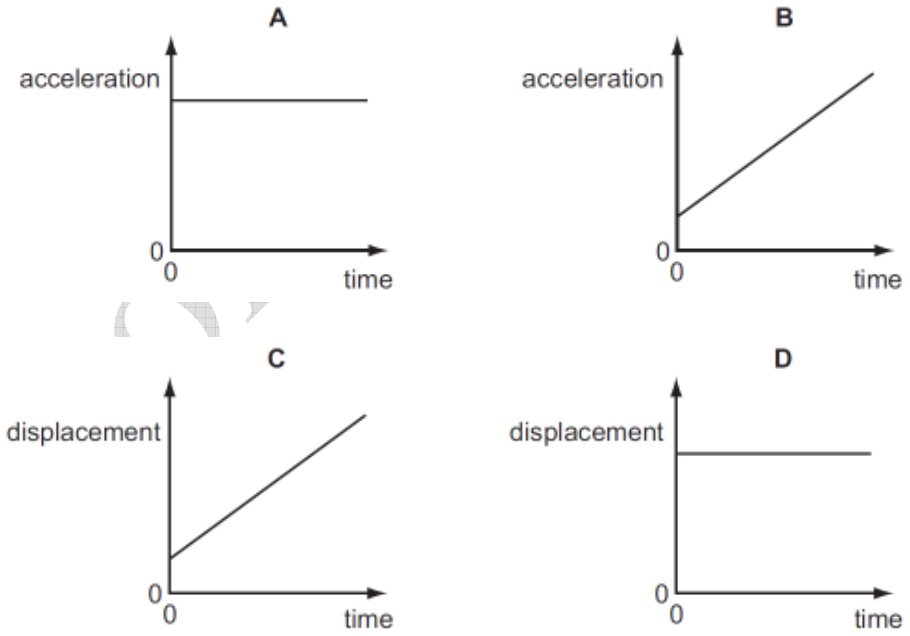


What is the distance travelled during the first 4.0 s?

A 2.5 m **B** 3.0 m **C** 20 m **D** 28 m

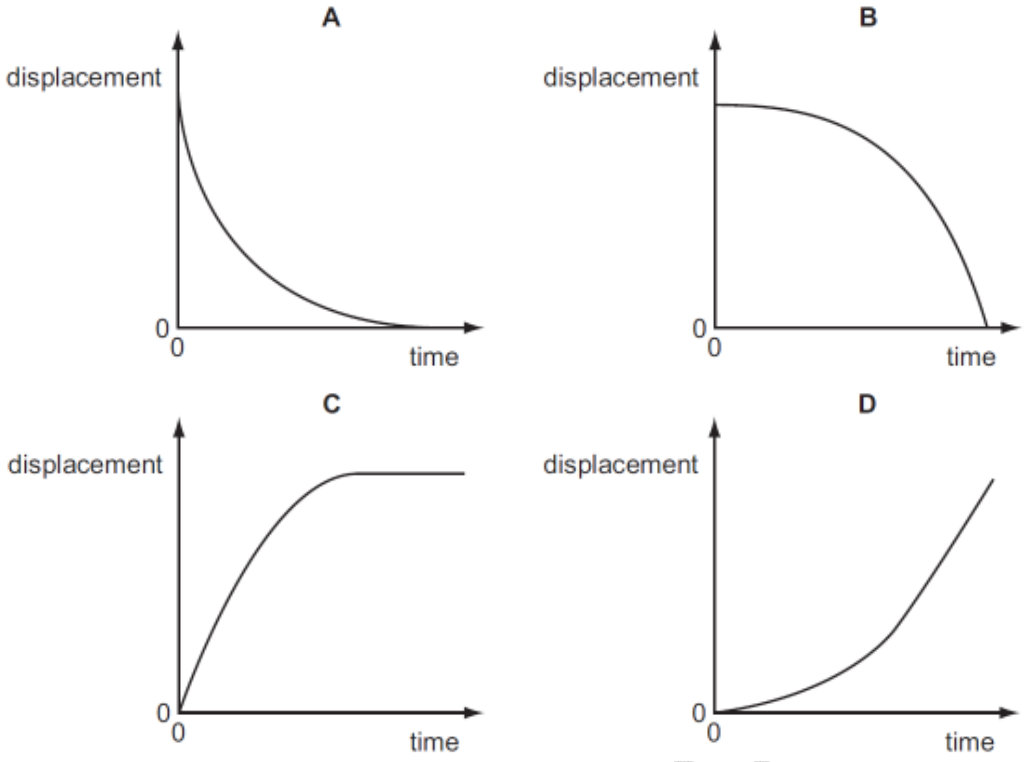
****38 Nov 08 P1 Q8**

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



***39 June 09 P1 Q5**

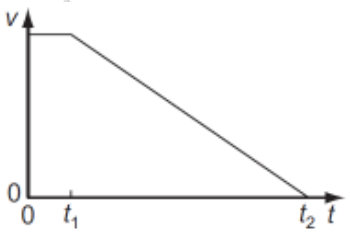
5 Which displacement-time graph best represents the motion of a falling sphere, the initial acceleration of which eventually reduces until it begins to travel at constant terminal velocity?



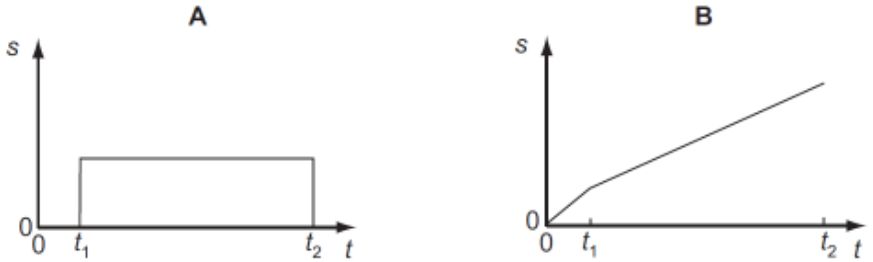
*****40 June 09 P1 Q6**

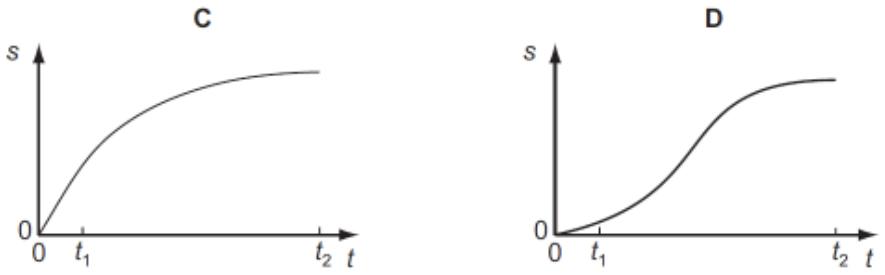
6 When a car driver sees a hazard ahead, she applies the brakes as soon as she can and brings the car to rest.

The graph shows how the speed v of the car varies with time t after she sees the hazard.



Which graph represents the variation with time t of the distance s travelled by the car after she has seen the hazard?





3.1 Linear Motion
Section B

1 June 02 P2 Q4

A steel ball of mass 73 g is held 1.6 m above a horizontal steel plate, as illustrated in Fig. 4.1.

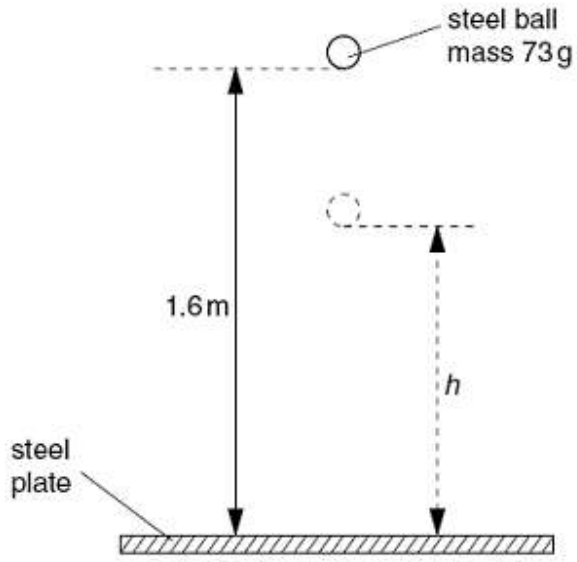


Fig. 4.1

The ball is dropped from rest and it bounces on the plate, reaching a height *h*.

(a) Calculate the speed of the ball as it reaches the plate.

speed = ... $m\,s^{-1}$ [2]

(b) As the ball loses contact with the plate after bouncing, the kinetic energy of the ball is 90% of that just before bouncing. Calculate

(i) the height h to which the ball bounces,

h = ... m

(ii) the speed of the ball as it leaves the plate after bouncing.

speed = ... $m\,s^{-1}$ [4]

(c) Using your answers to **(a)** and **(b)**, determine the change in momentum of the ball during the bounce.

change = ... N s [3]

(d) With reference to the law of conservation of momentum, comment on your answer to **(c)**.

.....

.....

.....[3]

2 Nov 02 P2 Q3

A ball falls from rest onto a flat horizontal surface. Fig. 3.1 shows the variation with time *t* of the velocity *v* of the ball as it approaches and rebounds from the surface.

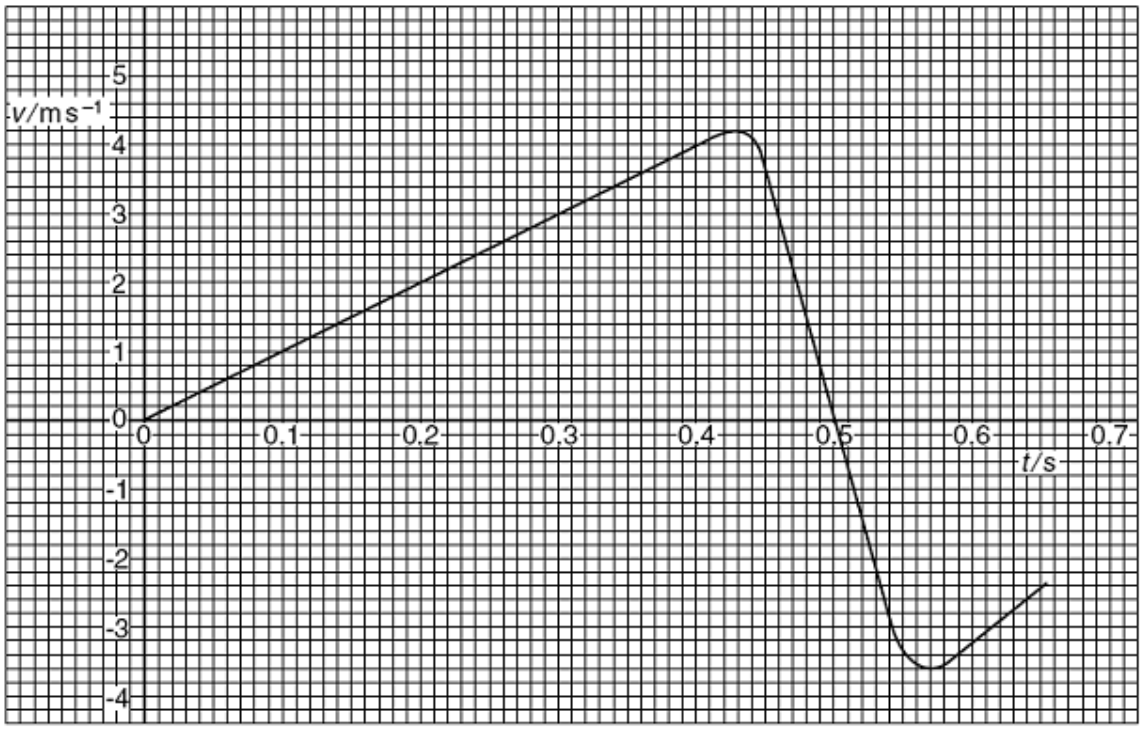


Fig. 3.1

Use data from Fig. 3.1 to determine

(a) the distance travelled by the ball during the first 0.40 s,

distance = ... m [2]

(b) the change in momentum of the ball, of mass 45 g, during contact of the ball with the surface,

change = ... N s [4]

(c) the average force acting on the ball during contact with the surface.

force = ... N [2]

3 June 03 P2 Q1

(a) (i) Define displacement.

.....

.....

(ii) Use your definition to explain how it is possible for a car to travel a certain distance and yet have zero displacement.

.....

.....

[3]

(b) A car starts from rest and travels upwards along a straight road inclined at an angle of 5.0° to the horizontal, as illustrated in Fig. 2.1.

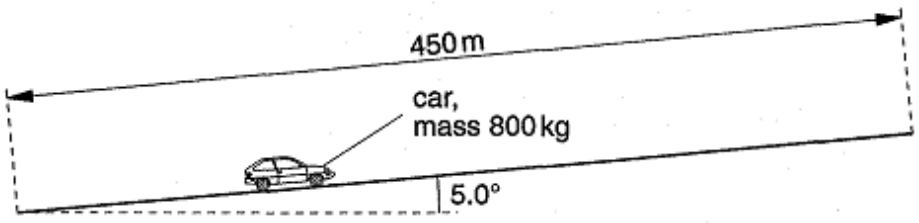


Fig. 2.1

The length of the road is 450 m and the car has mass 800 kg. The speed of the car increases at a constant rate and is 28 m s^{-1} at the top of the slope.

(i) Determine, for this car travelling up the slope,

1. its acceleration,

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

2. the time taken to travel the length of the slope,

time taken = ... s [2]

3. the gain in kinetic energy,

gain in kinetic energy = ... J [2]

4. the gain in gravitational potential energy.

gain in potential energy = ... J [3]

(ii) Use your answers in **(i)** to determine the useful output power of the car.

power = ... W [3]

(iii) Suggest one reason why the actual power output of the car engine is greater than that calculated in **(ii)**.

.....

..... [2]

4 Nov 03 P2 Q1

1 (a) One of the equations of motion may be written as

$$v^2 = u^2 + 2as.$$

(i) Name the quantity represented by the symbol *a*.

.....

(ii) The quantity represented by the symbol *a* may be either positive or negative. State the significance of a negative value.

.....

[2]

(b) A student investigates the motion of a small polystyrene sphere as it falls from rest alongside a vertical scale marked in centimetres. To do this, a number of flash photographs of the sphere are taken at 0.1 s intervals, as shown in Fig. 1.1.

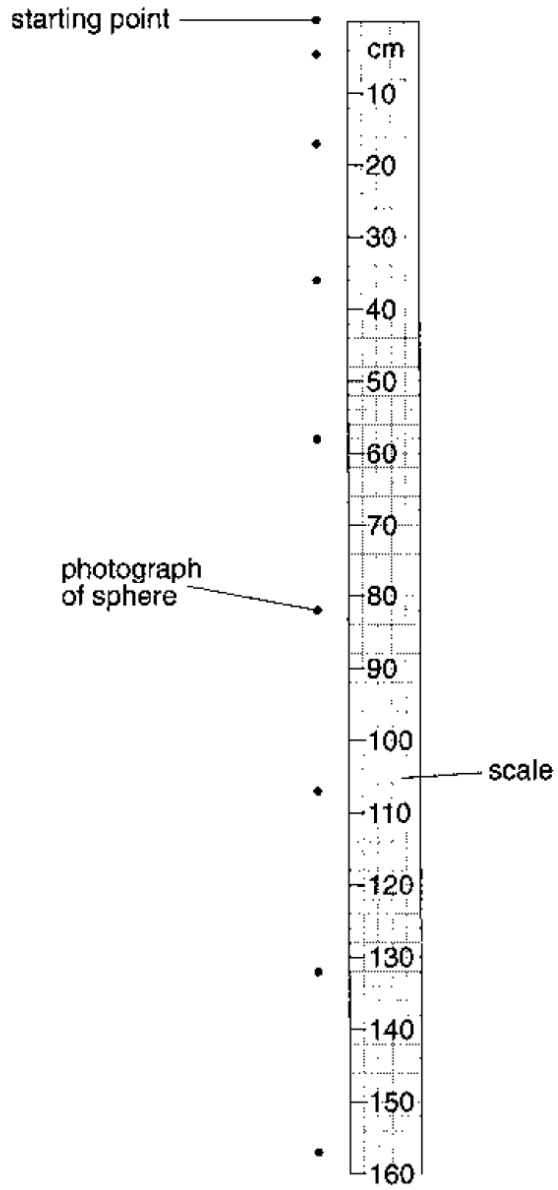


Fig. 1.1

The first photograph is taken at time $t = 0$.

By reference to Fig. 1.1,

(i) briefly explain how it can be deduced that the sphere reaches a constant speed,

.....

.....

(ii) determine the distance that the sphere has fallen from rest during a time of

1. 0.7 s,

distance = ... cm

2. 1.1 s.

distance = ... cm
[4]

(c) The student repeats the experiment with a lead sphere that falls with constant acceleration and does not reach a constant speed.

Determine the number of flash photographs that will be observed against the 160 cm scale.

Include in your answer the photograph obtained at time $t = 0$.

number = ... [3]

5 June 04 P2 Q3

3 A student has been asked to determine the linear acceleration of a toy car as it moves down a slope. He sets up the apparatus as shown in Fig. 3.1.

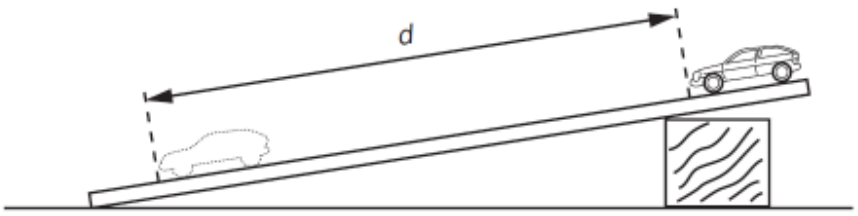


Fig. 3.1

The time t to move from rest through a distance d is found for different values of d. A graph of d (y-axis) is plotted against t^2 (x-axis) as shown in Fig. 3.2.

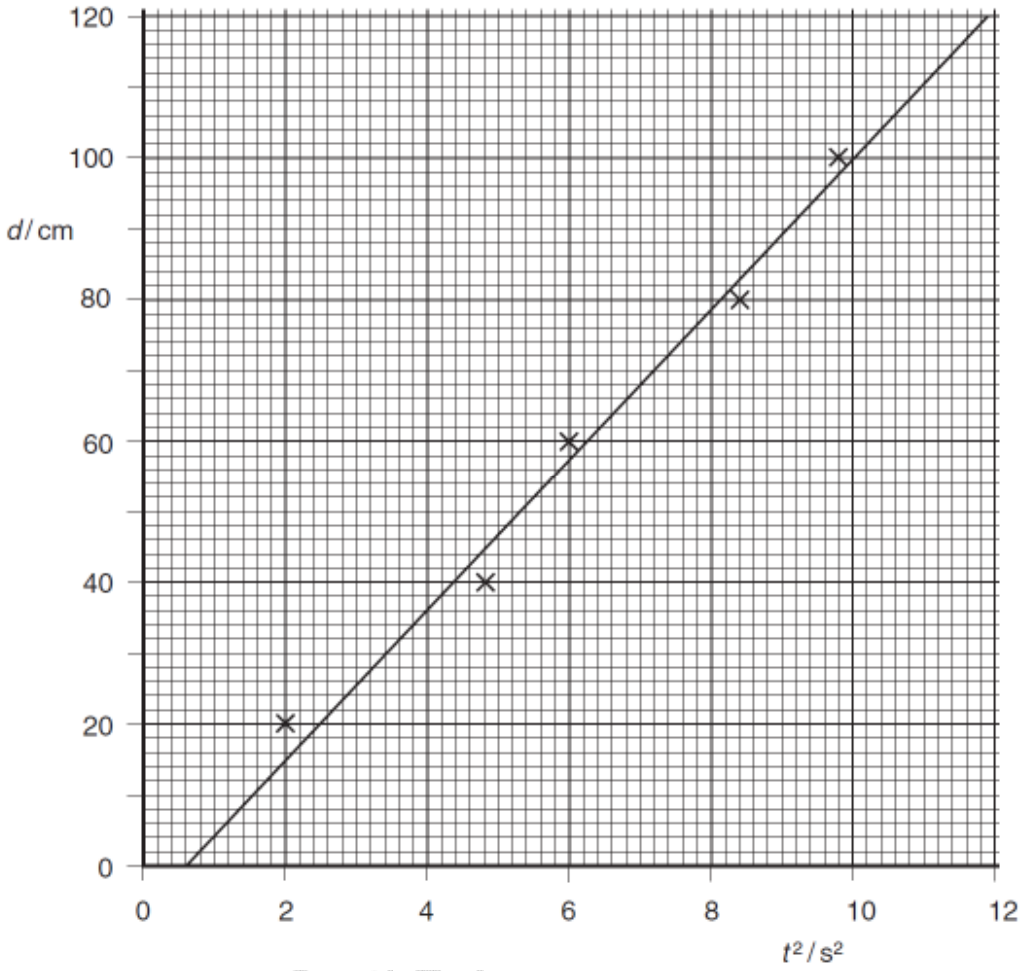


Fig. 3.2

(a) Theory suggests that the graph is a straight line through the origin.
Name the feature on Fig. 3.2 that indicates the presence of

(i) random error,

.....

(ii) systematic error.

.....

[2]

(b) **(i)** Determine the gradient of the line of the graph in Fig. 3.2.

gradient = ... [2]

(ii) Use your answer to **(i)** to calculate the acceleration of the toy down the slope. Explain your working.

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

6 Nov 04 P2 Q3

A girl stands at the top of a cliff and throws a ball vertically upwards with a speed of $12\,m\,s^{-1}$, as illustrated in Fig. 3.1.

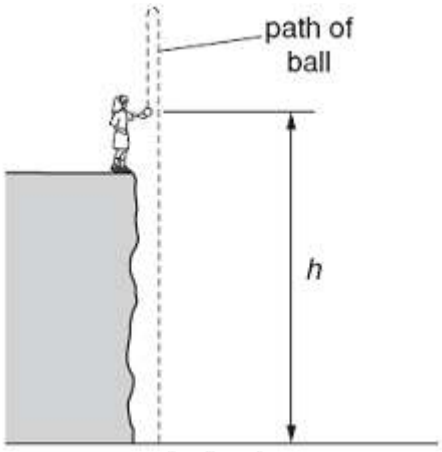
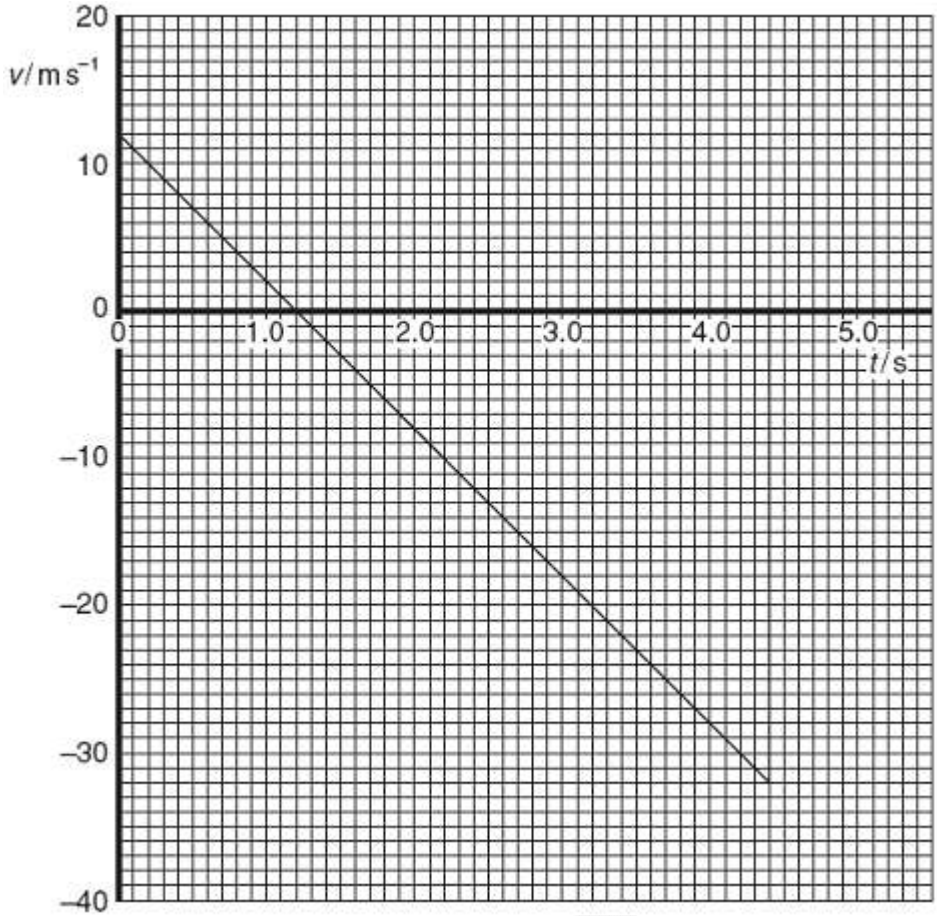


Fig. 3.1

At the time that the girl throws the ball, her hand is a height *h* above the horizontal ground at the base of the cliff.

The variation with time *t* of the speed *v* of the ball is shown in Fig. 3.2.



Speeds in the upward direction are shown as being positive. Speeds in the downward direction are negative.

(a) State the feature of Fig. 3.2 that shows that the acceleration is constant.

..... [1]

(b) Use Fig. 3.2 to determine the time at which the ball

(i) reaches maximum height,

time = ... s

(ii) hits the ground at the base of the cliff.

time = ... s
[2]

(c) Determine the maximum height above the base of the cliff to which the ball rises.

height = ... m [3]

(d) The ball has mass 250 g. Calculate the magnitude of the change in momentum of the ball between the time that it leaves the girl's hand to time $t = 4.0$ s.

change = ... N s [3]

(e) **(i)** State the principle of conservation of momentum.

.....

.....

..... [2]

(ii) Comment on your answer to **(d)** by reference to this principle.

.....

.....

.....

..... [3]

7 Nov 06 P2 Q2

2 A student investigates the speed of a trolley as it rolls down a slope, as illustrated in Fig. 2.1.

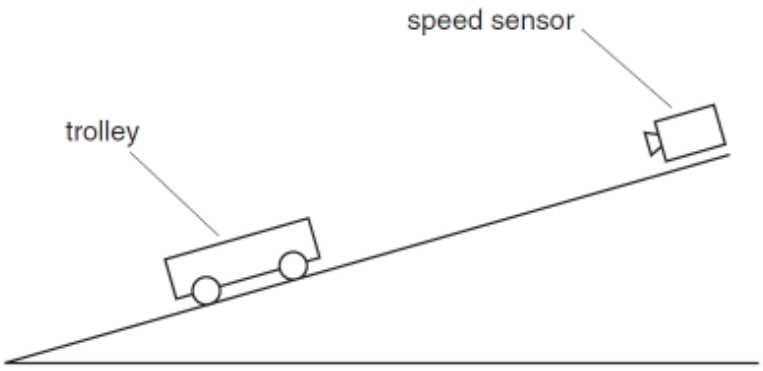


Fig. 2.1

The speed v of the trolley is measured using a speed sensor for different values of the time t that the trolley has moved from rest down the slope.

Fig. 2.2 shows the variation with t of v.

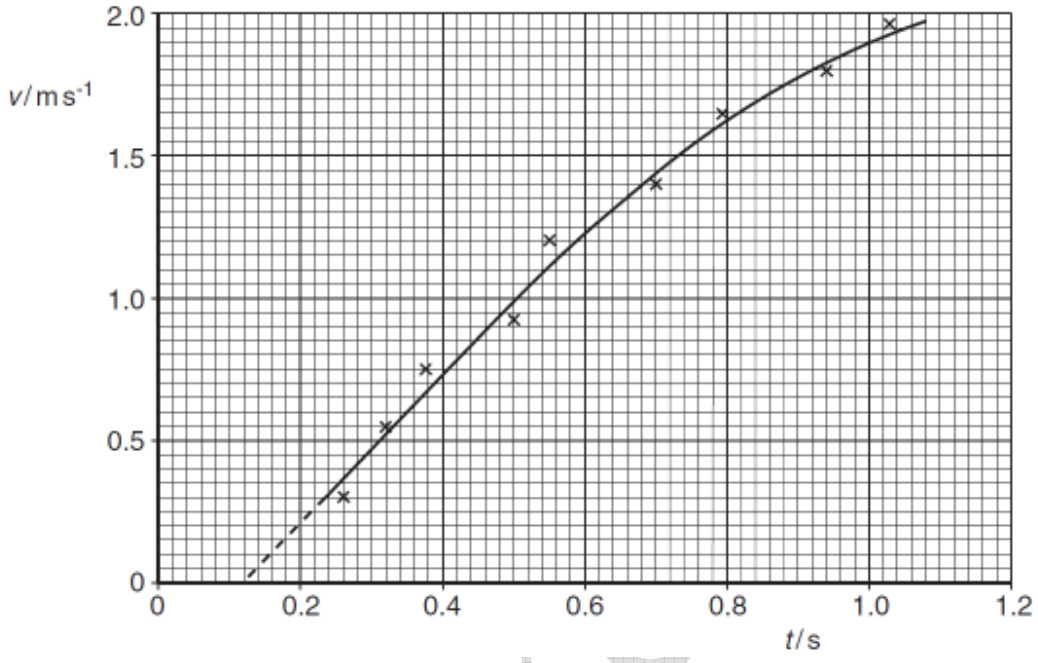


Fig. 2.2

(a) Use Fig. 2.2 to determine the acceleration of the trolley at the point on the graph where $t = 0.80$ s.

acceleration = ... m s^{-2} [4]

(b) (i) State whether the acceleration is increasing or decreasing for values of t greater than 0.6 s. Justify your answer by reference to Fig. 2.2.

.....

.....

..... [2]

(ii) Suggest an explanation for this change in acceleration.

.....

..... [1]

(c) Name the feature of Fig. 2.2 that indicates the presence of

(i) random error,

.....

..... [1]

(ii) systematic error.

.....

..... [1]

8 Nov 07 P1 Q2

2 A girl G is riding a bicycle at a constant velocity of $3.5\,m\,s^{-1}$. At time $t = 0$, she passes a boy B sitting on a bicycle that is stationary, as illustrated in Fig. 2.1.

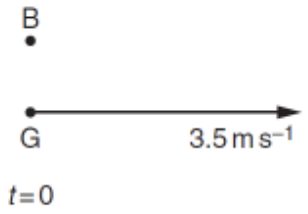


Fig. 2.1

At time $t = 0$, the boy sets off to catch up with the girl. He accelerates uniformly from time $t = 0$ until he reaches a speed of $5.6\,m\,s^{-1}$ in a time of 5.0 s. He then continues at a constant speed of $5.6\,m\,s^{-1}$. At time $t = T$, the boy catches up with the girl.
T is measured in seconds.

(a) State, in terms of T, the distance moved by the girl before the boy catches up with her.

distance = ... m [1]

(b) For the boy, determine

(i) the distance moved during his acceleration,

distance = ... m [2]

(ii) the distance moved during the time that he is moving at constant speed.
Give your answer in terms of T.

distance = ... m [1]

(c) Use your answers in **(a)** and **(b)** to determine the time T taken for the boy to catch up with the girl.

T = ... s [2]

(d) The boy and the bicycle have a combined mass of 67 kg.

(i) Calculate the force required to cause the acceleration of the boy.

force = ... N [3]

(ii) At a speed of $4.5\,m\,s^{-1}$, the total resistive force acting on the boy and bicycle is 23 N.
Determine the output power of the boy's legs at this speed.

power = ... W [2]

9 Nov 08 P2 Q2

2 A car is travelling along a straight road at speed *v*. A hazard suddenly appears in front of the car. In the time interval between the hazard appearing and the brakes on the car coming into operation, the car moves forward a distance of 29.3 m. With the brakes applied, the front wheels of the car leave skid marks on the road that are 12.8 m long, as illustrated in Fig. 2.1.

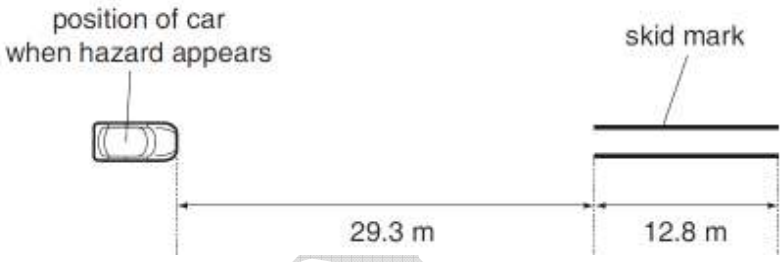


Fig. 2.1

It is estimated that, during the skid, the magnitude of the deceleration of the car is 0.85 *g*, where *g* is the acceleration of free fall.

(a) Determine

(i) the speed *v* of the car before the brakes are applied,

v = ... $m s^{-1}$ [2]

(ii) the time interval between the hazard appearing and the brakes being applied.

time = ... s [2]

(b) The legal speed limit on the road is 60 km per hour.
Use both of your answers in **(a)** to comment on the standard of the driving of the car.

.....

.....

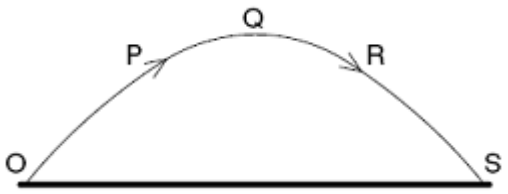
.....

..... [3]

3.2 Non-linear Motion
Section A

**1 Nov 02 P1 Q8

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.

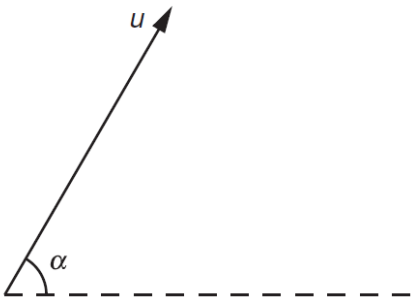
B The horizontal component of the projectile's velocity is zero.

C The kinetic energy of the projectile is zero.

D The momentum of the projectile is zero.

**2 June 03 P1 Q7

7 A projectile is fired at an angle α to the horizontal at a speed u, as shown.

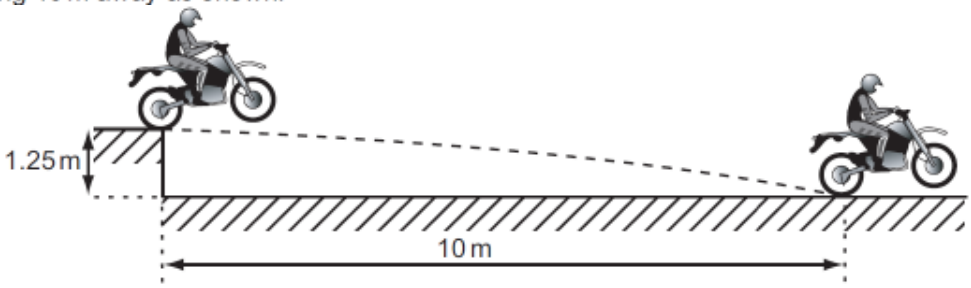


What will be the vertical and horizontal components of its velocity after a time t?
Assume that air resistance is negligible. The acceleration of free fall is g.

	vertical component	horizontal component
A	$u \sin \alpha$	$u \cos \alpha$
B	$u \sin \alpha - gt$	$u \cos \alpha - gt$
C	$u \sin \alpha - gt$	$u \cos \alpha$
D	$u \cos \alpha$	$u \sin \alpha - gt$

*****3 June 04 P1 Q9**

9 A motorcycle stunt-rider moving horizontally takes off from a point 1.25 m above the ground, landing 10 m away as shown.

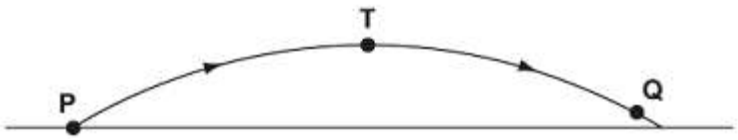


What was the speed at take-off?

A $5\,\text{m s}^{-1}$ **B** $10\,\text{m s}^{-1}$ **C** $15\,\text{m s}^{-1}$ **D** $20\,\text{m s}^{-1}$

***4 Nov 04 P1 Q7**

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**.

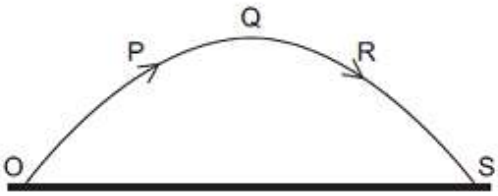
B greatest at **T**.

C greatest at **Q**.

D the same at **Q** as at **T**.

***5 June 05 P1 Q9**

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.

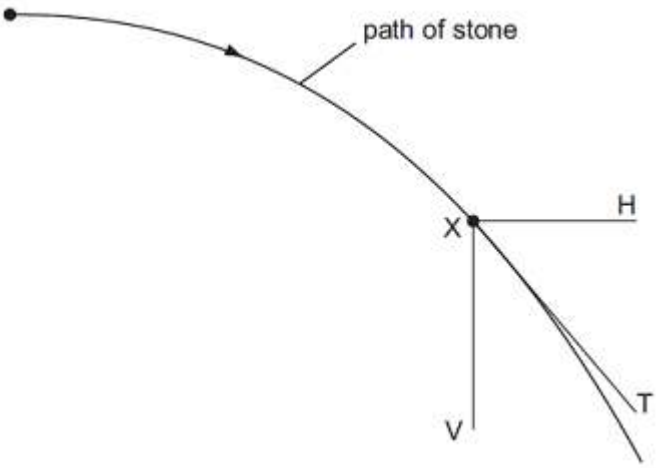
B The horizontal component of the projectile's velocity is zero.

C The kinetic energy of the projectile is zero.

D The momentum of the projectile is zero.

****6 Nov 05 P1 Q11**

A stone is projected horizontally in a vacuum and moves along a path as shown. X is a point on this path. XV and XH are vertical and horizontal lines respectively through X. XT is the tangent to the path at X.

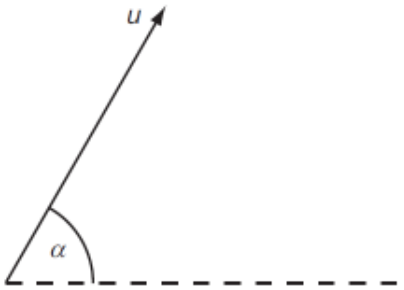


Along which direction or directions do forces act on the stone at X?

A XV **B** XH **C** XV and XH **D** XT

****7 Nov 06 Q9**

9 A projectile is fired at an angle α to the horizontal at a speed u, as shown.



What are the vertical and horizontal components of its velocity after a time t?
Assume that air resistance is negligible. The acceleration of free fall is g.

	vertical component	horizontal component
A	$u \sin \alpha$	$u \cos \alpha$
B	$u \sin \alpha - gt$	$u \cos \alpha - gt$
C	$u \sin \alpha - gt$	$u \cos \alpha$
D	$u \cos \alpha$	$u \sin \alpha - gt$

****8 June 08 P1 Q6**

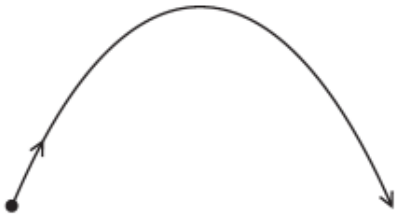
6 An object accelerates in a direction that is always perpendicular to its motion.

What is the effect, if any, of the acceleration on the object's speed and direction?

	speed	direction
A	changes	changes
B	changes	constant
C	constant	changes
D	constant	constant

**9 Nov 08 P1 Q7

7 A stone is thrown upwards and follows a curved path.



Air resistance is negligible.

Why does the path have this shape?

A The stone has a constant horizontal velocity and constant vertical acceleration.

B The stone has a constant horizontal acceleration and constant vertical velocity.

C The stone has a constant upward acceleration followed by a constant downward acceleration.

D The stone has a constant upward velocity followed by a constant downward velocity.

3.2 Non- Linear Motion
Section B

1 Nov 05 P2 Q3

3 A stone on a string is made to travel along a horizontal circular path, as shown in Fig. 3.1.

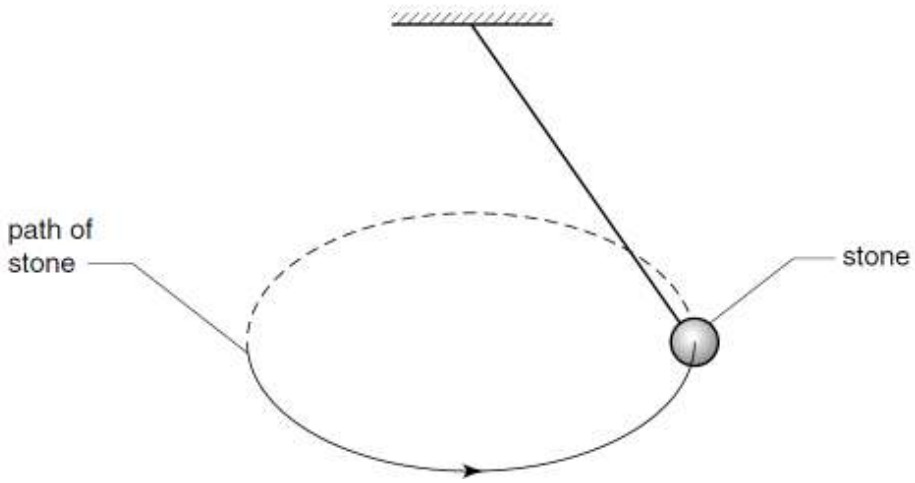


Fig. 3.1

The stone has a constant speed.

(a) Define *acceleration*.

.....

..... [1]

(b) Use your definition to explain whether the stone is accelerating.

.....

.....

..... [2]

(c) The stone has a weight of 5.0 N. When the string makes an angle of 35° to the vertical, the tension in the string is 6.1 N, as illustrated in Fig. 3.2.

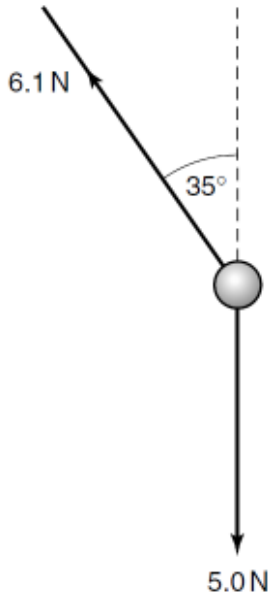


Fig. 3.2

Determine the resultant force acting on the stone in the position shown.

magnitude of force = ... N

direction of force..... [4]