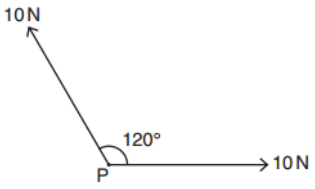
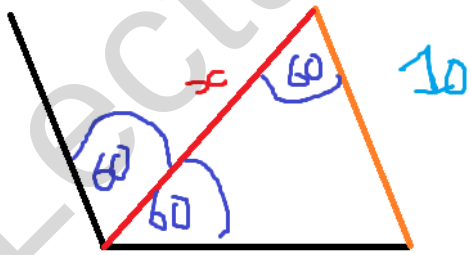
3 Two forces, each of 10 N, act at a point P as shown in the diagram. The angle between the directions of the forces is 120°.



What is the magnitude of the resultant force?

A 5 N **B** 10 N **C** 17 N **D** 20 N



$x = 10N$

5 A student makes measurements from which she calculates the speed of sound as 327.66 m s^{-1}. She estimates that her result is accurate to ±3 %.

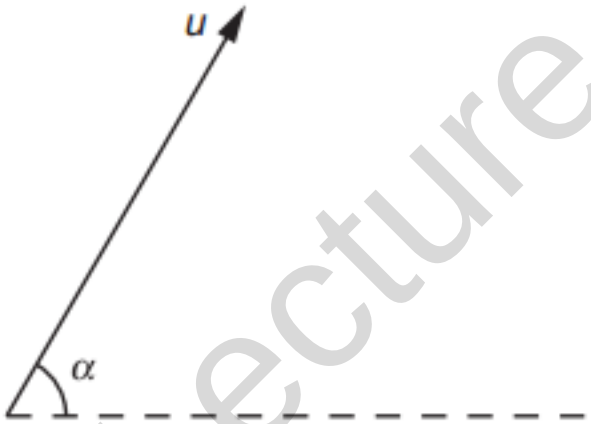
Which of the following gives her result expressed to the appropriate number of significant figures?

A 327.7 m s^{-1} **B** 328 m s^{-1} **C** 330 m s^{-1} **D** 300 m s^{-1}

327.66 * (3/100)
= 9.8298

Check to see which option has the uncertainty closest to 9.8298
C- (300) * (3/100)
= 9.9

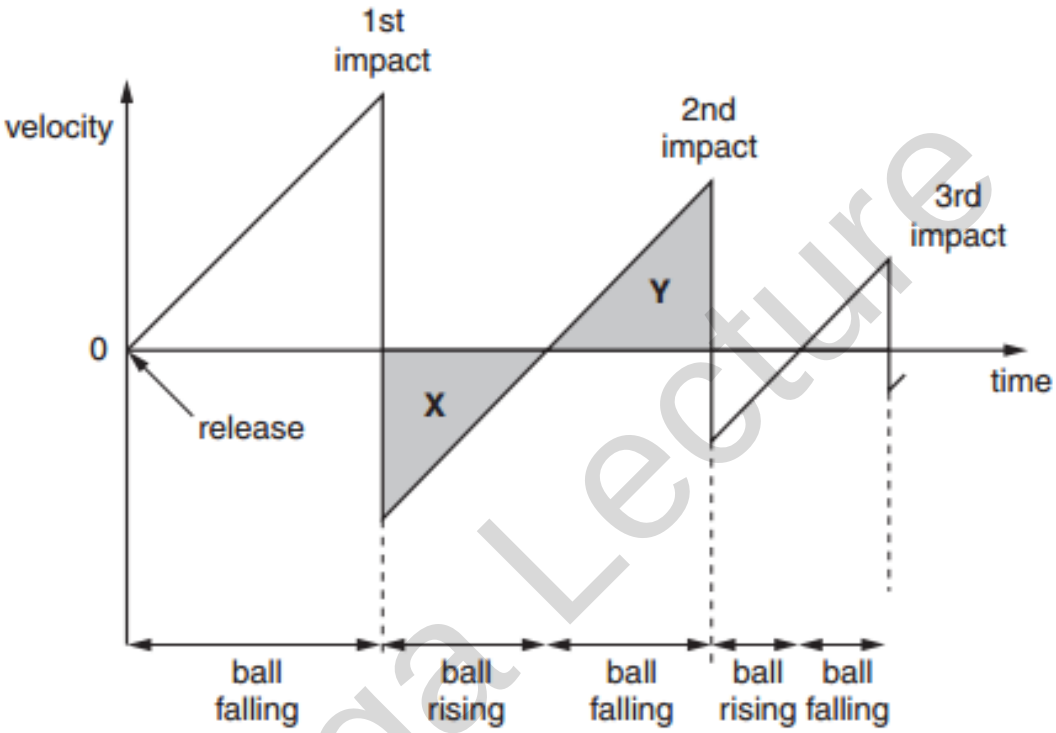
7 A projectile is fired at an angle α to the horizontal at a speed u, as shown.



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	$u \cos \alpha$	$u \sin \alpha - gt$

9 A ball is released from rest above a horizontal surface. The graph shows the variation with time of its velocity.



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

This is because

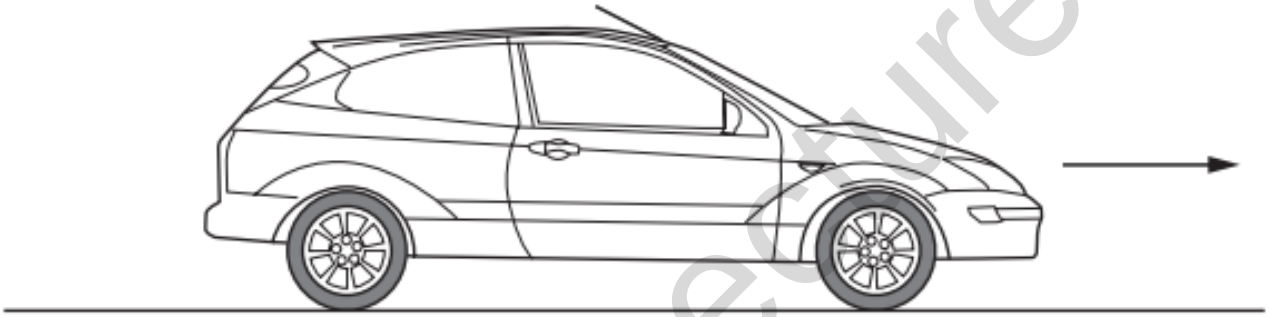
A the ball's acceleration is the same during its upward and downward motion.

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.

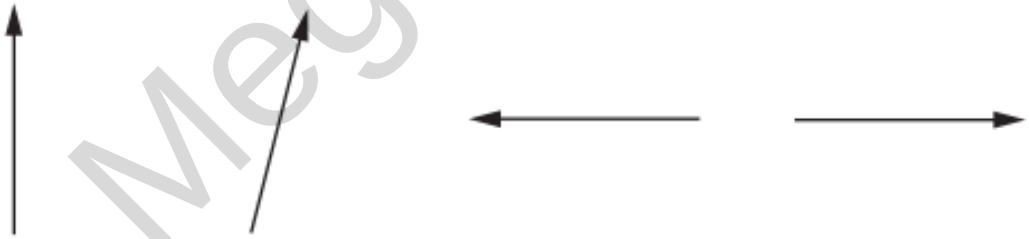
D the ball rises and falls through the same distance between impacts.

11 A car with front-wheel drive accelerates in the direction shown.

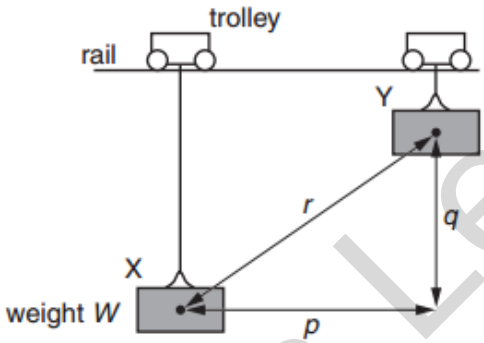


Which diagram best shows the direction of the total force exerted by the road on the front wheels?

A **B** **C** **D**



17 A weight *W* hangs from a trolley that runs along a rail. The trolley moves horizontally through a distance *p* and simultaneously raises the weight through a height *q*.



As a result, the weight moves through a distance *r* from X to Y. It starts and finishes at rest.

How much work is done on the weight during this process?

A *Wp* **B** *W*(*p* + *q*) **C** *Wq* **D** *Wr*

Workdone = mgh

w is the WEIGHT

weight = mg

Thus

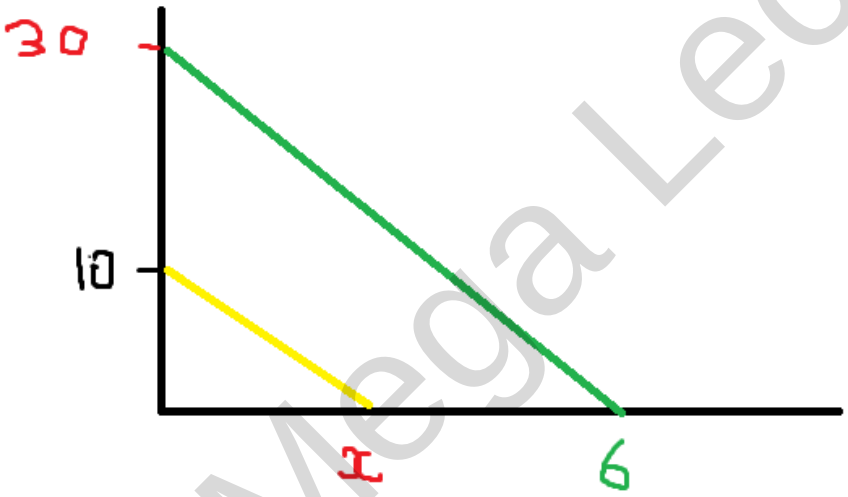
W * height

W * q

18 A motorist travelling at 10 m s^{-1} can bring his car to rest in a distance of 10 m.

If he had been travelling at 30 m s^{-1}, in what distance could he bring the car to rest using the same braking force?

A 17 m **B** 30 m **C** 52 m **D** 90 m



1/2 (x)(10) = (10)

x = 2 s

Ratio between speed and time

10:2
5:1

30:x
x = 6

1/2 (6)(30) = 90 m

20 A child drinks a liquid of density ρ through a vertical straw.

Atmospheric pressure is p_0 and the child is capable of lowering the pressure at the top of the straw by 10%. The acceleration of free fall is g.

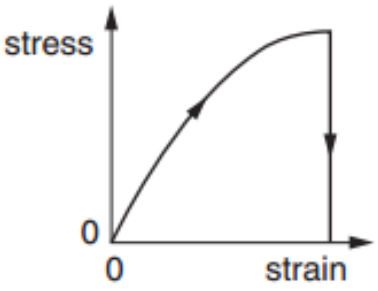
What is the maximum length of straw that would enable the child to drink the liquid?

A $\frac{p_0}{10\rho g}$ **B** $\frac{9p_0}{10\rho g}$ **C** $\frac{p_0}{\rho g}$ **D** $\frac{10p_0}{\rho g}$

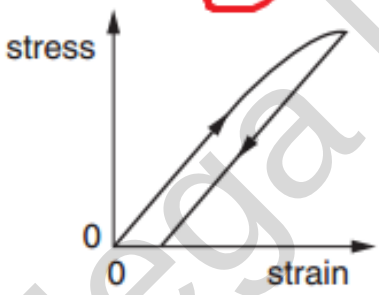
19 A suspended copper wire is gradually loaded until it is stretched just beyond the elastic limit, and it is then gradually unloaded.

Which graph (with arrows indicating the sequence) best illustrates the variation of the tensile stress with longitudinal strain?

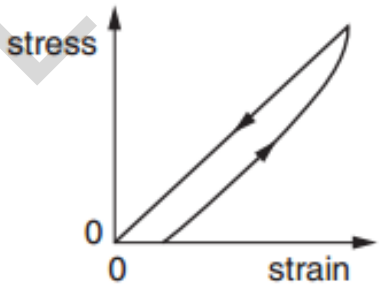
A



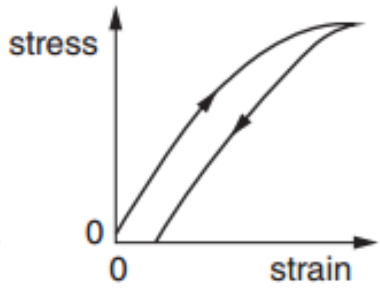
B



C



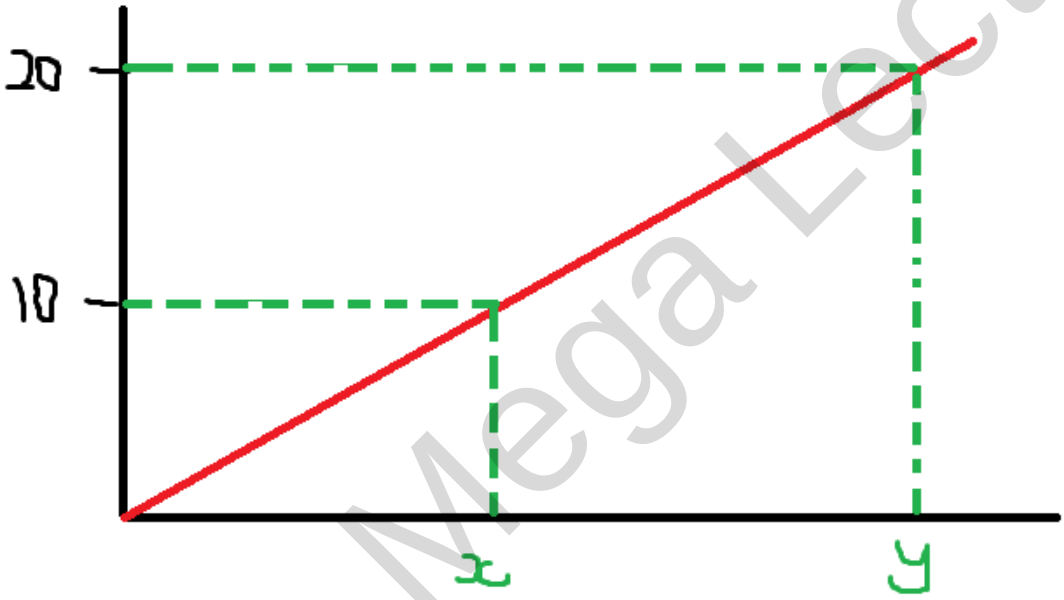
D



7 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}



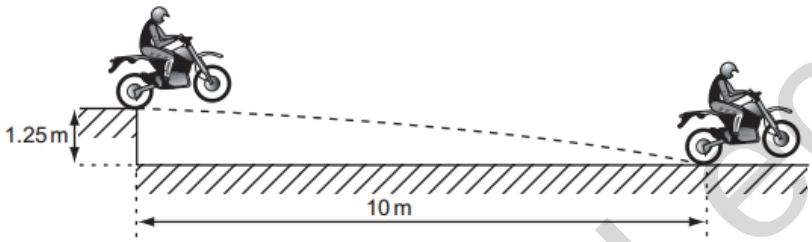
(1/2) * 10 * (x) = 100
x = 20 s

(1/2) * (y - x) * (10 + 20) = 100
y = 26.67 s

2 points = (20, 10) (26.67, 20)

GRADIENT = ACCELERATION
GRADIENT = 1.49 = 1.5 ms^-2

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 $5\,ms^{-1}$ **B** $10\,ms^{-1}$ **C** $15\,ms^{-1}$ **D** $20\,ms^{-1}$

Dealing with the vertical components:

s = ut + 1/2(a)(t^2)

1.25 = 0 (t) + 1/2 (9.81) (t^2)
t = 0.505 s

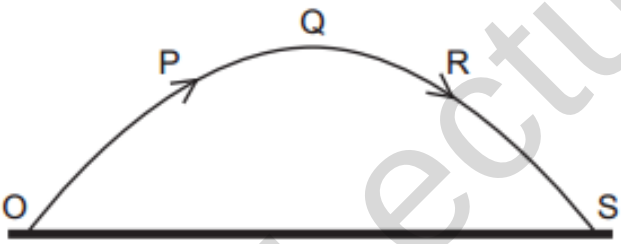
Dealing with the horizantal components:

v = s/t

v = 10/0.505

v = 19.8 = 20 ms^-2

9 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?

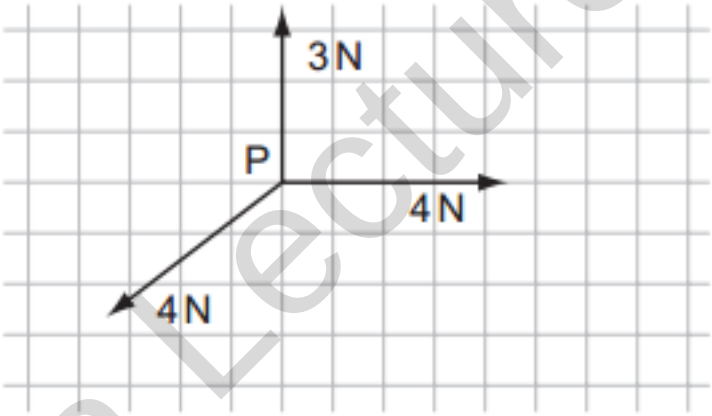
A The horizontal component of the projectile's acceleration is zero.

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.

14 The vector diagram shows three coplanar forces acting on an object at P.



The magnitude of the resultant of these three forces is 1 N.

What is the direction of this resultant?

A ↓ B ↘ C ↙ D ↗

7 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	$-9.81\,m\,s^{-2}$

18 The hydrostatic pressure p at a depth h in a liquid of density ρ is given by the formula $p = h\rho g$.

Which equation, or principle of physics, is used in the derivation of this formula?

A density = mass ÷ volume

B potential energy = mgh

C atmospheric pressure decreases with height

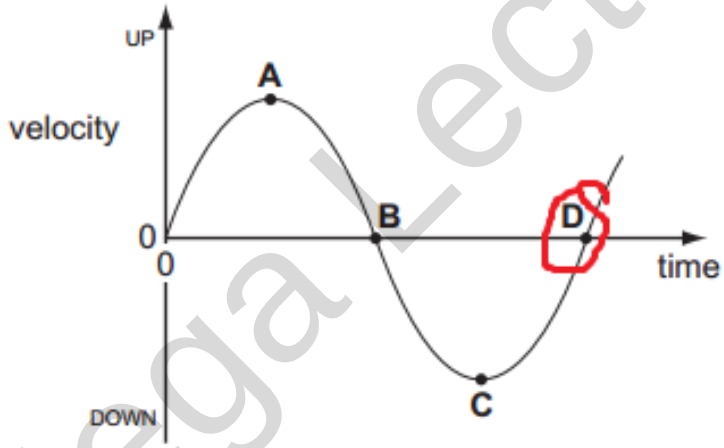
D density increases with depth

2 For which quantity is the magnitude a reasonable estimate?

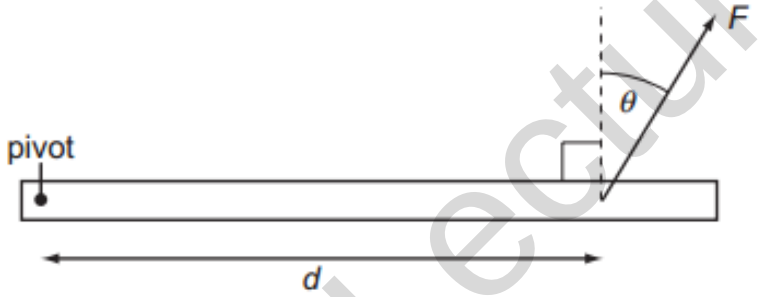
A	frequency of a radio wave	500 pHz
B	mass of an atom	500 μg
C	the Young modulus of a metal	500 kPa
D	wavelength of green light	500 nm

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?



14 A force F is applied to a beam at a distance d from a pivot. The force acts at an angle θ to a line perpendicular to the beam.



Which combination will cause the largest turning effect about the pivot?

	F	d	θ
A	large	large	large
B	large	large	small
C	small	small	large
D	small	large	small

16 What is the internal energy of an object?

A It is the energy associated with the object's movement through space.

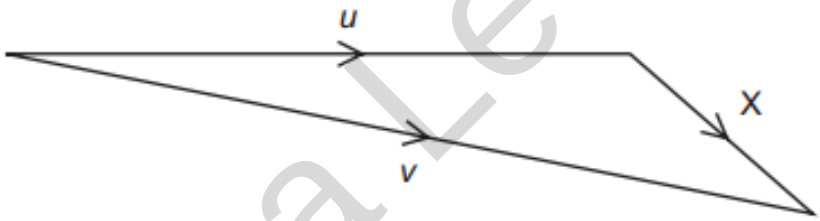
B It is the energy associated with the random movement of the molecules in the object.

C It is the energy due to the attractions between the molecules within the object.

D It is the sum of all the microscopic potential and kinetic energies of the molecules.

7 An object has an initial velocity u. It is subjected to a constant force F for t seconds, causing a constant acceleration a. The force is **not** in the same direction as the initial velocity.

A vector diagram is drawn to find the final velocity v.



What is the length of side X of the vector diagram?

A F **B** Ft **C** at **D** $u + at$

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

s = ut + (1/2) (a) (t^2)
40 = 1/2 (9.81) (t^2)
t = 2.86 s

Time take for 30 m:

30 = 1/2 (9.81) (t^2)
t = 2.47 s

ANSWER = 2.86 - 2.47
= 0.39

2 Which of the following correctly expresses the volt in terms of SI base units?

A $A\Omega$

B WA^{-1}

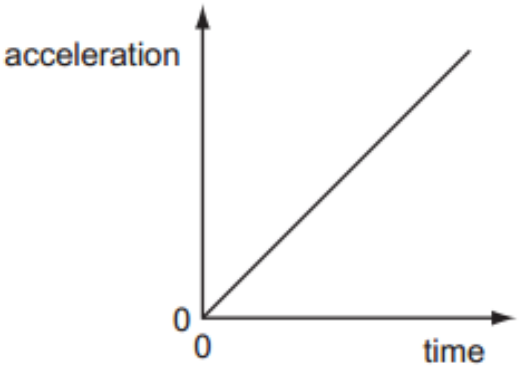
C $kg\,m^2\,s^{-1}\,A^{-1}$

D $kg\,m^2\,s^{-3}\,A^{-1}$

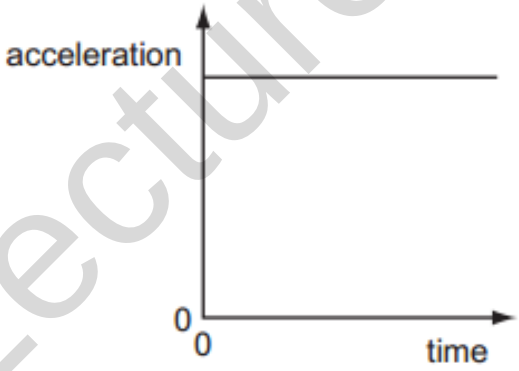
8 A football is dropped from the top of a tall building.

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

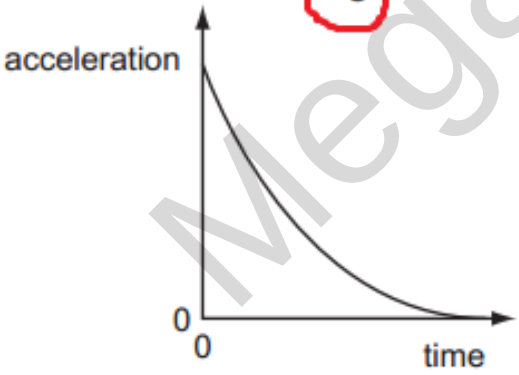
A



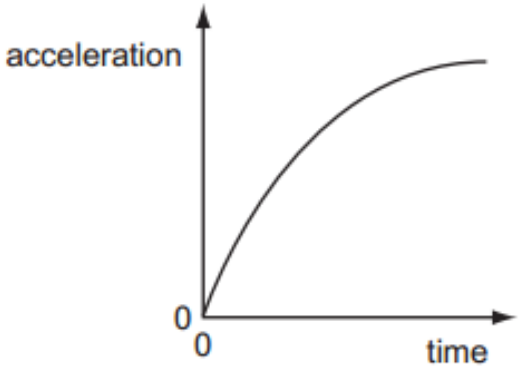
B



C



D



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?

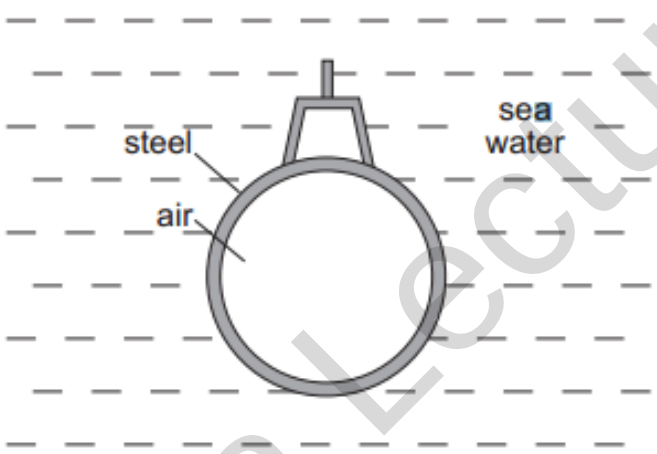
A upthrust → viscous drag → weight

B viscous drag → upthrust → weight

C viscous drag → weight → upthrust

D weight → upthrust → viscous drag

15 A submarine is in equilibrium in a fully submerged position.



What causes the upthrust on the submarine?

A The air in the submarine is less dense than sea water.

B The sea water exerts a greater upward force on the submarine than the weight of the steel.

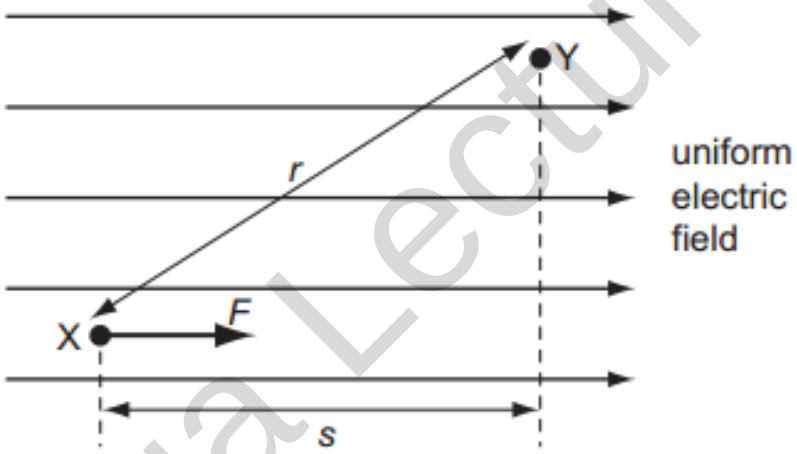
C The submarine displaces its own volume of sea water.

D There is a difference in water pressure acting on the top and bottom of the submarine.

16 A positive charge experiences a force *F* when placed at point X in a uniform electric field.

The charge is then moved from point X to point Y.

Distances *r* and *s* are shown on the diagram.



What is the change in the potential energy of the charge?

A decreases by *Fs*

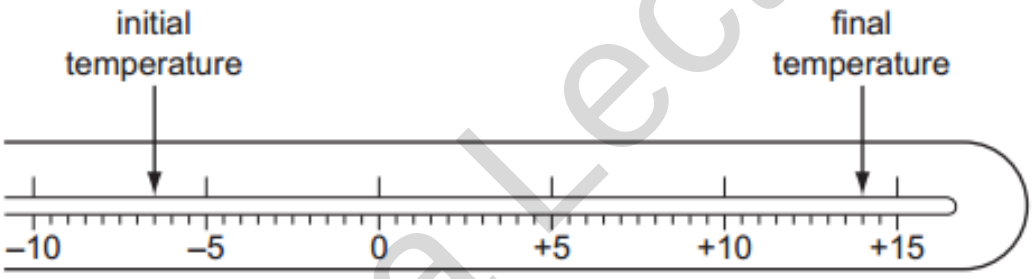
B increases by *Fs*

C decreases by *Fr*

D increases by *Fr*

Potential energy decreases in the direction of the electric field

3 The diagram shows the stem of a Celsius thermometer marked to show initial and final temperature values.

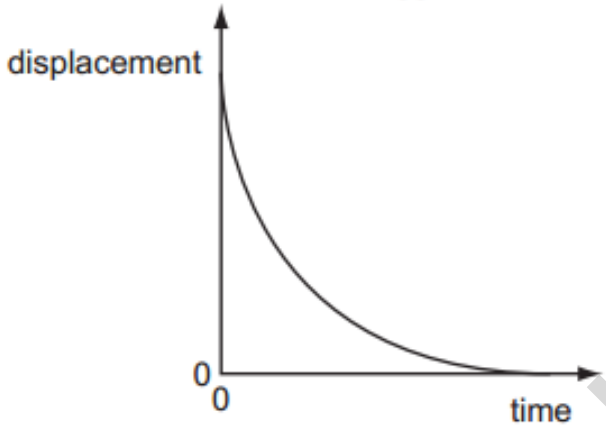


What is the temperature change expressed to an appropriate number of significant figures?

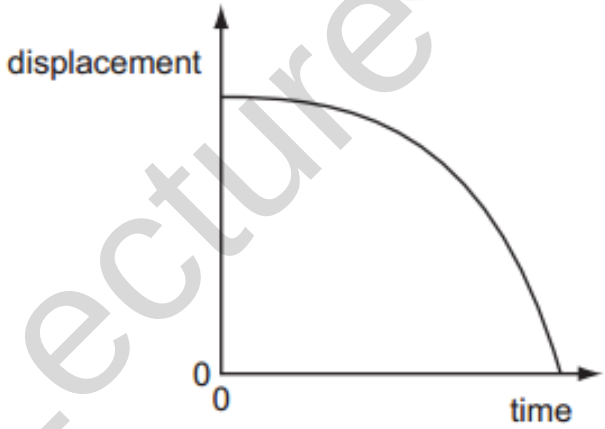
A 14 °C **B** 20.5 °C **C** 21 °C **D** 22.0 °C

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?

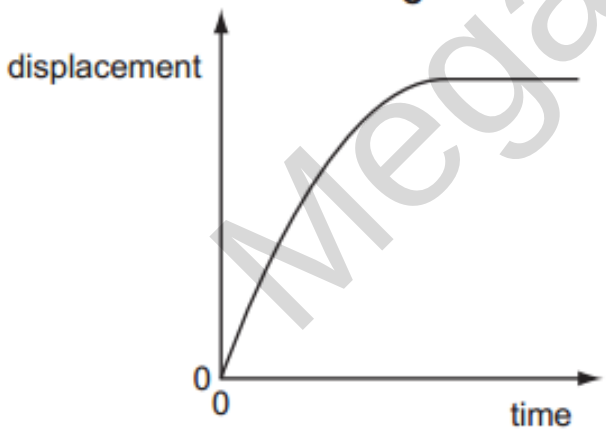
A



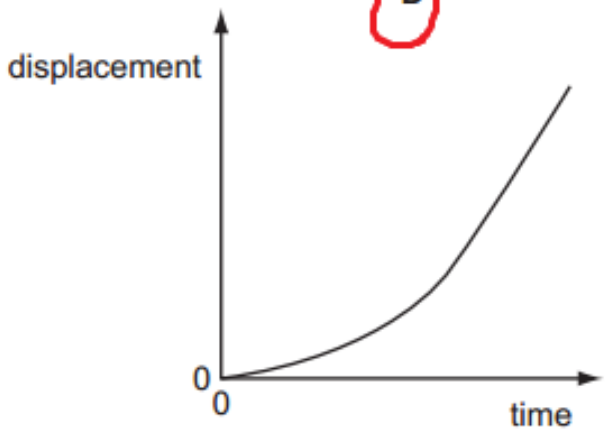
B



C



D



7 Which statement about Newton's laws of motion is correct?

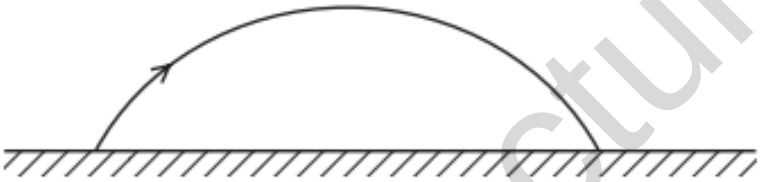
A The first law follows from the second law.

B The third law follows from the second law.

C Conservation of energy is a consequence of the third law.

D Conservation of linear momentum is a consequence of the first law.

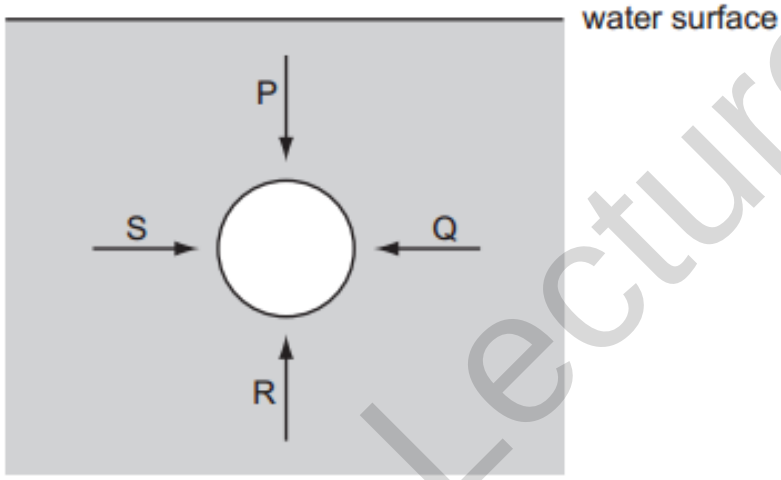
8 The diagram shows the path of a golf ball.



Which row describes changes in the horizontal and vertical components of the golf ball's velocity, when air resistance forces are ignored?

	horizontal	vertical
A	constant deceleration	constant acceleration downwards
B	constant deceleration	acceleration decreases upwards then increases downwards
C	constant velocity	constant acceleration downwards
D	constant velocity	acceleration decreases upwards then increases downwards

11 The diagram represents a sphere under water. P, Q, R, and S are forces acting on the sphere, due to the pressure of the water.



Each force acts perpendicularly to the sphere's surface. P and R act in opposite directions vertically. Q and S act in opposite directions horizontally.

Which information about the magnitudes of the forces is correct?

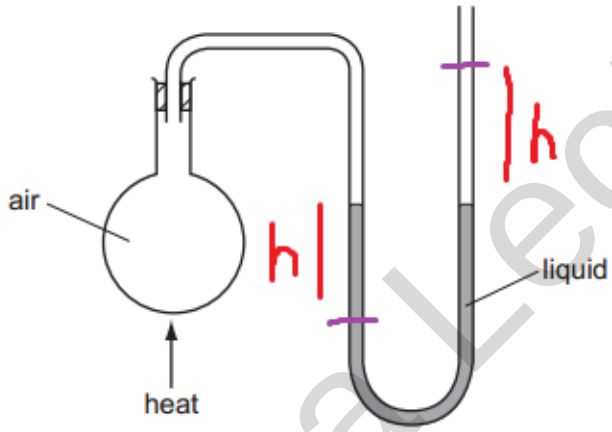
A P < R ; S = Q

B P > R ; S = Q

C P = R ; S = Q

D P = R = S = Q

18 The diagram shows a flask connected to a U-tube containing liquid. The flask contains air at atmospheric pressure.



Thus the distance between the 2 purple marks will be 2h

The flask is now gently heated and the liquid level in the right-hand side of the U-tube rises through a distance h. The density of the liquid is ρ.

What is the increase in pressure of the heated air in the flask?

A $h\rho$ **B** $\frac{1}{2}h\rho g$ **C** $h\rho g$ **D** $2h\rho g$

3 An ion is accelerated by a series of electrodes in a vacuum. A graph of the power supplied to the ion is plotted against time.

What is represented by the area under the graph between two times?

A the change in kinetic energy of the ion

B the average force on the ion

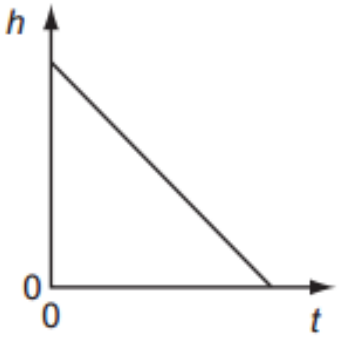
C the change in momentum of the ion

D the change in velocity of the ion

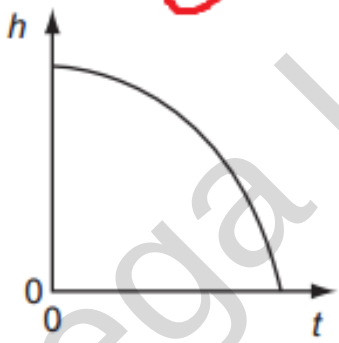
9 A small steel ball falls freely under gravity after being released from rest.

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

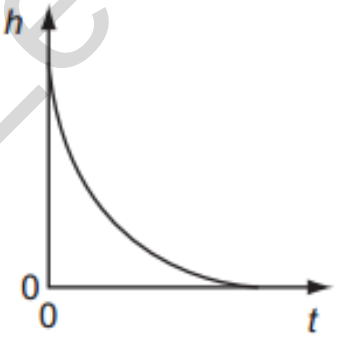
A



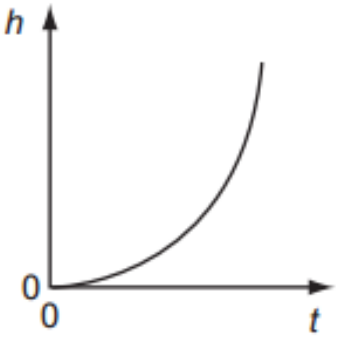
B



C



D



13 Forces of 3 N, 4 N and 5 N act at one point on an object. The angles at which the forces act can vary.

What is the value of the **minimum** resultant force of these forces?

A 0

B between 0 and 2 N

C 2 N

D between 2 N and 4 N

15 A force of 1000 N is needed to lift the hook of a crane at a steady velocity. The crane is then used to lift a load of mass 1000 kg at a velocity of 0.50 $m\,s^{-1}$.

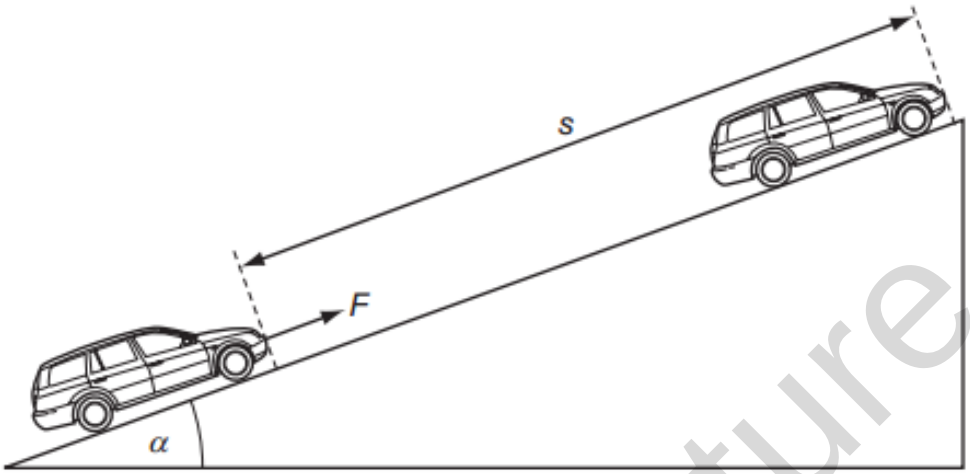
How much of the power developed by the motor of the crane is used in lifting the hook and the load? Assume that the acceleration of free fall g is equal to 10 $m\,s^{-2}$.

A 5.0 kW **B** 5.5 kW **C** 20 kW **D** 22 kW

Force required to lift hook = 1000 N
Weight of Load = 1000 * 10 = 10,000 N

P = F * v
P = (10,000 + 1000) * 0.50
p = 5500 W = 5.5 kW

16 A constant force F, acting on a car of mass m, moves the car up the slope through a distance s at constant velocity v. The angle of the slope to the horizontal is α.



Which expression gives the efficiency of the process?

A $\frac{mgs\sin\alpha}{Fv}$ **B** $\frac{mv}{Fs}$ **C** $\frac{mv^2}{2Fs}$ **D** $\frac{mg\sin\alpha}{F}$

NOTE : POTENTIAL ENERGY WILL BE INCLUDED IN THE OUTPUT POWER PART OF THE EQUATION

h = sin a
E. p = mg (sin a) = Energy

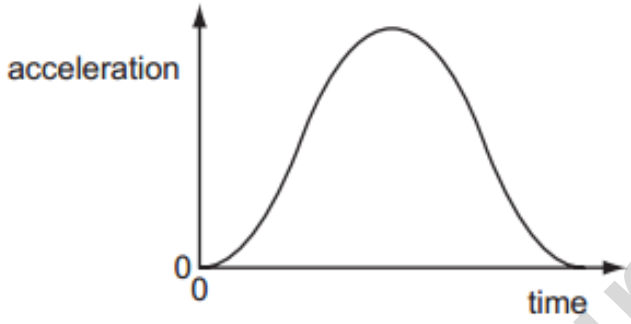
Output Power = [mg (sina)] * s

Input Power = F * s

Efficieny = { [mg (sin a)] * s} / (F *s)

Efficiency = mg sin a / F

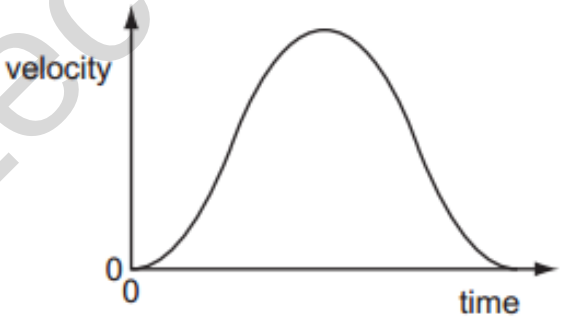
6 The graph shows how the acceleration of an object moving in a straight line varies with time.



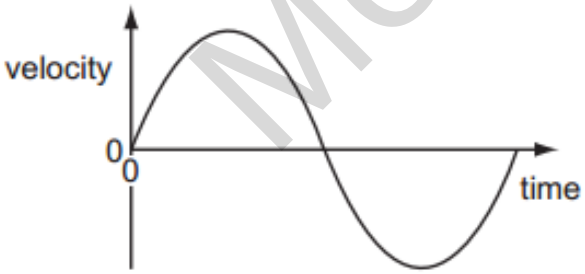
Which graph shows the variation with time of the velocity of the object?

A

B



C



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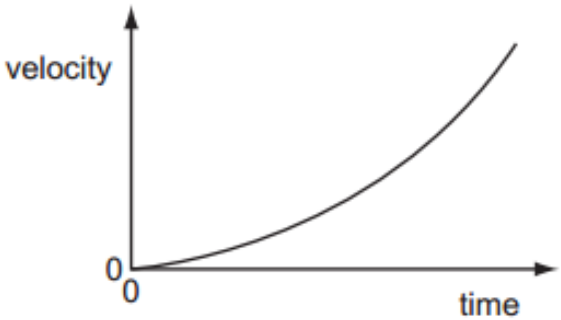
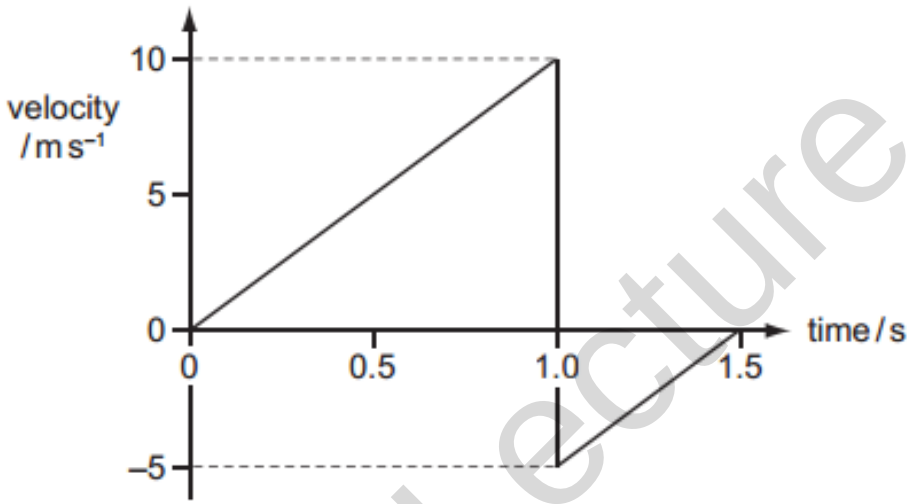


7 A ball is released from rest at time zero. After 1.0 s it bounces inelastically from a horizontal surface and rebounds, reaching the top of its first bounce after 1.5 s.



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

Total distance = (1/2) * 10 * 1.0
= 10 m

Total distance travelled = 6.25 m (find the area of the 2 traingles)

10 - 6.25 m
= 3.75 m

9 A body of mass m, moving at velocity v, collides with a stationary body of the same mass and sticks to it.

Which row describes the momentum and kinetic energy of the two bodies after the collision?

	momentum	kinetic energy
A	mv	$\frac{1}{4}mv^2$
B	mv	$\frac{1}{8}mv^2$
C	$2mv$	$\frac{1}{2}mv^2$
D	$2mv$	mv^2

10 A molecule of mass *m* travelling horizontally with velocity *u* hits a vertical wall at right-angles to its velocity. It then rebounds horizontally with the same speed.

What is its change in momentum?

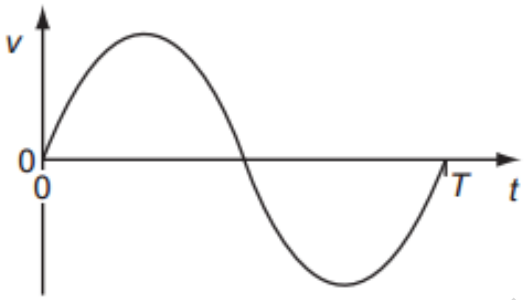
A zero **B** *mu* **C** $-mu$ **D** $-2mu$

14 A steel sphere is dropped vertically onto a horizontal metal plate. The sphere hits the plate with a speed u, leaves it at a speed v, and rebounds vertically to half of its original height.

Which expression gives the value of $\frac{v}{u}$?

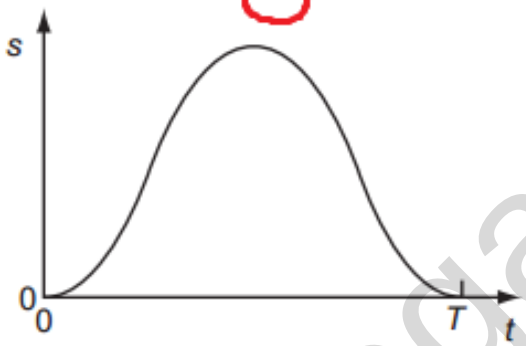
A $\frac{1}{2^2}$ **B** $\frac{1}{2}$ **C** $\frac{1}{\sqrt{2}}$ **D** $1 - \frac{1}{\sqrt{2}}$

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

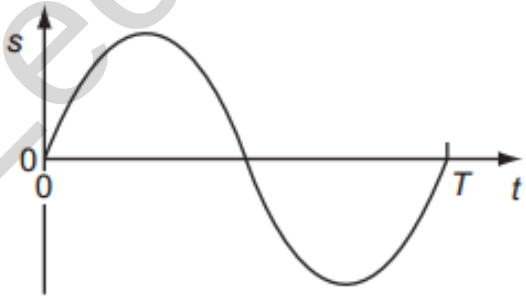


Which graph represents the displacement s of the object in the time $t = 0$ to $t = T$?

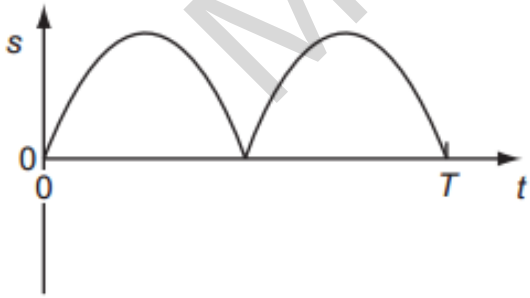
A



B



C



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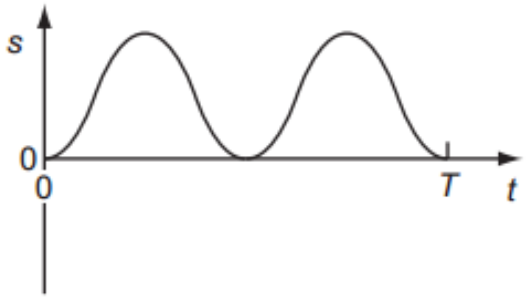
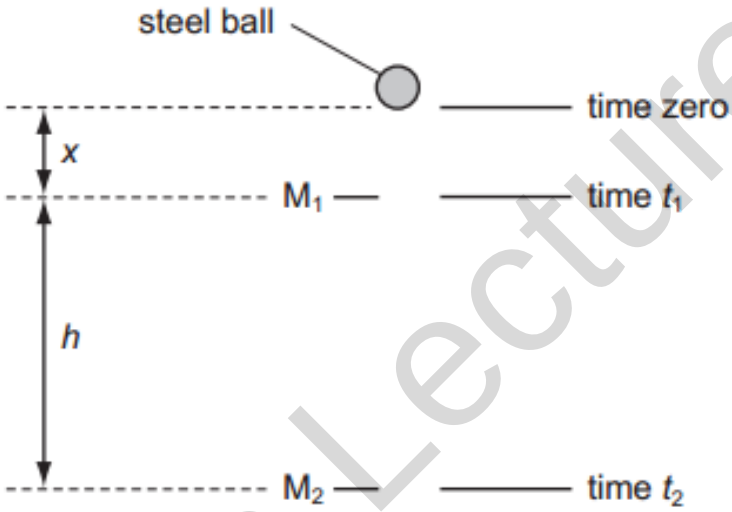


8 Two markers M_1 and M_2 are set up a vertical distance h apart.



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.

Which expression gives the acceleration of the ball?

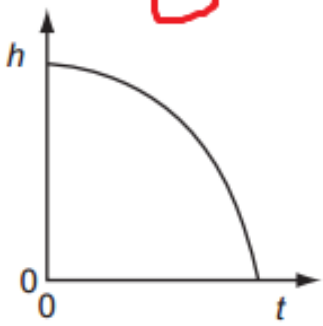
A $\frac{2h}{t_2^2}$ **B** $\frac{2h}{(t_2+t_1)}$ **C** $\frac{2h}{(t_2-t_1)^2}$ **D** $\frac{2h}{(t_2^2-t_1^2)}$

NOTE: BOTH TIMES
WILL BE SQUARED

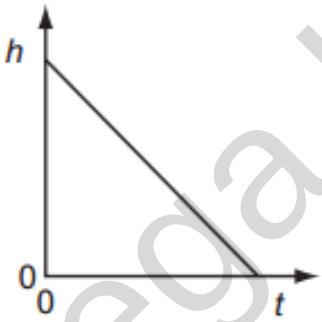
9 A brick is dislodged from a building and falls vertically under gravity.

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

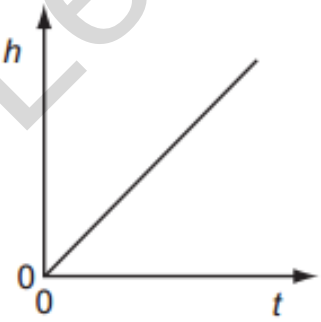
A



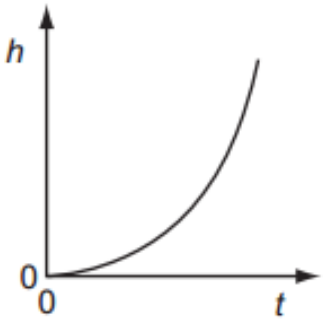
B



C



D



10 A mass accelerates uniformly when the resultant force acting on it

A is zero.

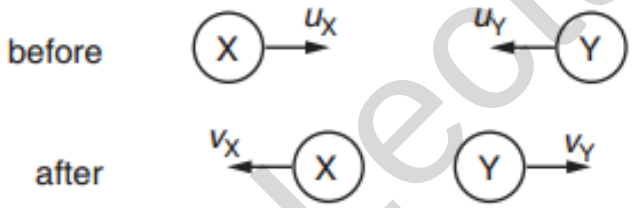
B is constant but not zero.

C increases uniformly with respect to time.

D is proportional to the displacement from a fixed point.

12 Two balls X and Y approach each other along the same straight line and collide elastically.

Their speeds are u_X and u_Y respectively. After the collision they move apart with speeds v_X and v_Y respectively. Their directions are shown on the diagram.



Which of the following equations is correct?

A $u_X + u_Y = v_X + v_Y$

B $u_X + u_Y = v_X - v_Y$

C $u_X - u_Y = v_X + v_Y$

D $u_X - u_Y = v_X - v_Y$

15 A force F is applied to a freely moving object. At one instant of time, the object has velocity v and acceleration a.

Which quantities **must** be in the same direction?

A a and v only

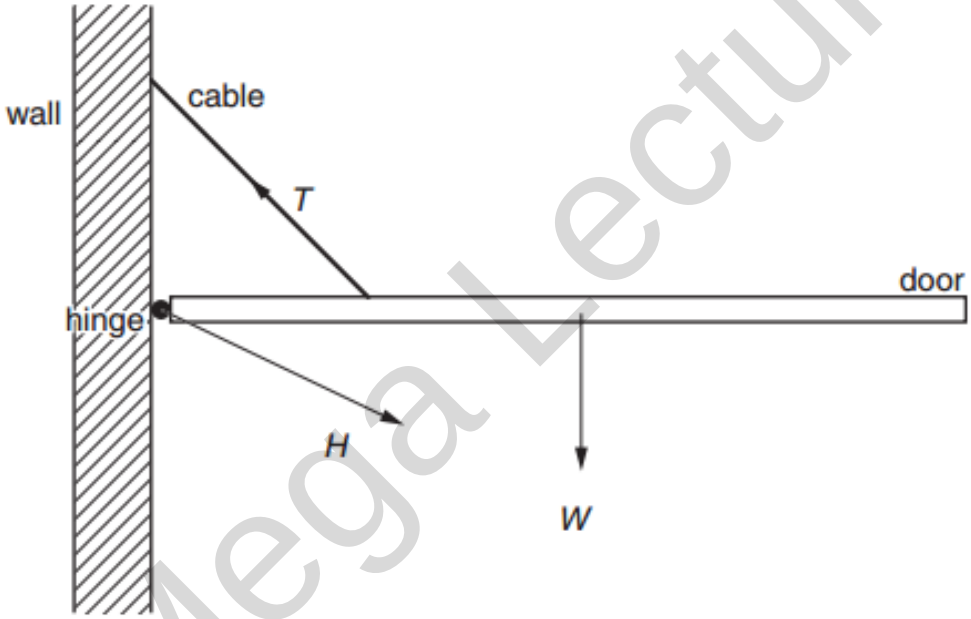
B a and F only

C v and F only

D v, F and a

16 A hinged door is held closed in the horizontal position by a cable.

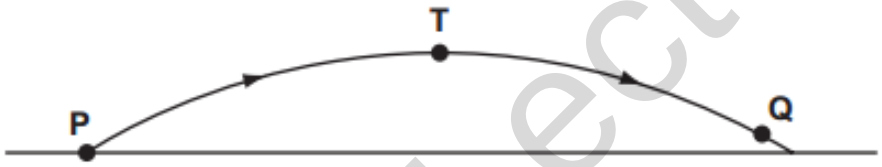
Three forces act on the door: the weight *W* of the door, the tension *T* in the cable, and the force *H* at the hinge.



Which list gives the three forces in **increasing** order of magnitude?

A *H*,*T*,*W** **B** *T*,*H*,*W** **C** *W*,*H*,*T** **D** *W*,*T*,*H*

7 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**.

14 An electron is situated in a uniform electric field, as shown in the diagram.

What is the direction of the electric force acting on the electron?

A downwards

B to the left

C to the right

D upwards

17 A cyclist is capable of generating an average power of 3.0 kW during a 4.0 km speed trial. His aerodynamic suit and position on the cycle reduce resistive forces to 180 N.

What is the approximate time achieved in the speed trial?

A 140 s **B** 240 s **C** 1300 s **D** 2200 s

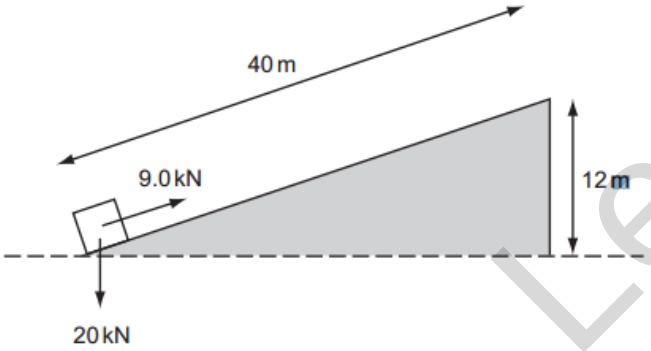
Power = Energy / Time

Power = F * s / t

3000 = 180 * 4000 / t

t = 240 s

18 A constant force of 9.0 kN, parallel to an inclined plane, moves a body of weight 20 kN through a distance of 40 m along the plane at constant speed. The body gains 12 m in height, as shown.



How much of the work done is dissipated as heat?

A 120 kJ **B** 240 kJ **C** 360 kJ **D** 600 kJ

Incase you are perplexed by the terms 'Output' and 'Input', please refer to MCQ no. 37

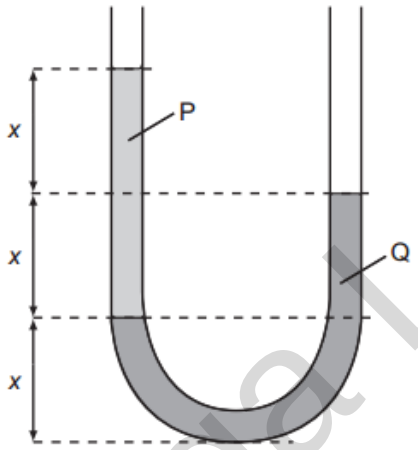
Output:
E.P = mgh
E.P = 20,000 (12) = 240,000 N

Input:
Workdone = F * s
= 9,000 * 40 = 360,000 N

Workdone dissipated as heat = 360,000 - 240,000

= 120,000
=120 kJ

20 The diagram shows two liquids, labelled P and Q, which do **not** mix. The liquids are in equilibrium in an open U-tube.



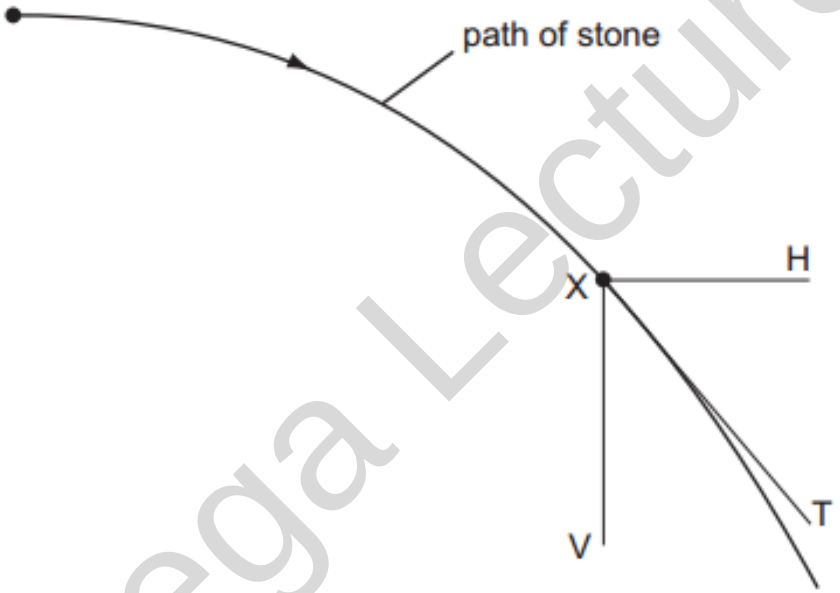
What is the ratio $\frac{\text{density of P}}{\text{density of Q}}$?

A $\frac{1}{2}$ **B** $\frac{2}{3}$ **C** $\frac{3}{2}$ **D** 2

Height of liquid column of P = 2x
Height of liquid column of Q = x

Thus the ratio of the densities is 1:2

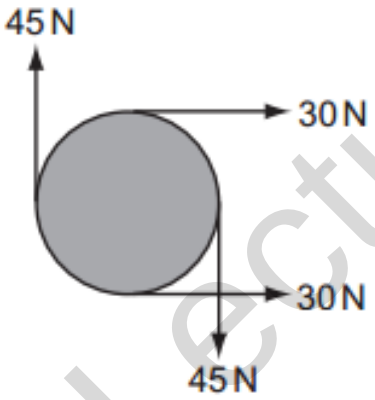
11 A stone is projected horizontally in a vacuum and moves along a path as shown. X is a point on this path. XV and XH are vertical and horizontal lines respectively through X. XT is the tangent to the path at X.



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

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

13 The diagram shows four forces applied to a circular object.



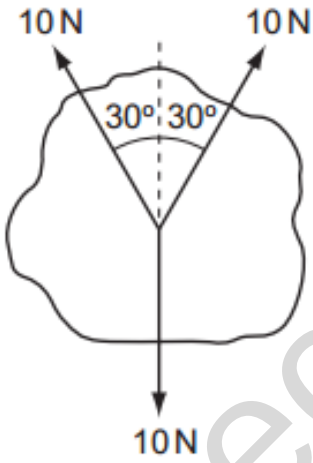
Which of the following describes the resultant force and resultant torque on the object?

	resultant force	resultant torque
A	non-zero	non-zero
B	non-zero	zero
C	zero	non-zero
D	zero	zero

3 Which row of the table shows a physical quantity and its correct unit?

	physical quantity	unit
A	electric field strength	$kg\,m\,s^{-2}\,C^{-1}$
B	specific heat capacity	$kg^{-1}\,m^{2}\,s^{-2}\,K^{-1}$
C	tensile strain	$kg\,m^{-1}\,s^{-2}$
D	the Young modulus	$kg\,m^{-1}\,s^{-3}$

15 Three coplanar forces, each of magnitude 10 N, act through the same point of a body in the directions shown.



What is the magnitude of the resultant force?

A 0 N **B** 1.3 N **C** 7.3 N **D** 10 N

Cos 30 = x / 10
x = 8.66

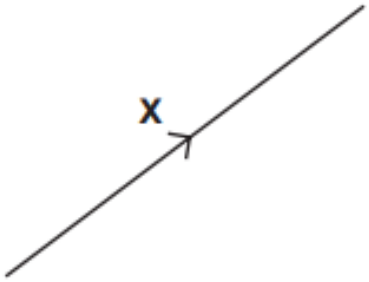
8.66 * 2
= 17.32

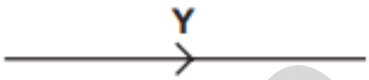
17.32 - 10
= 7.3 N

2 What is a reasonable estimate of the diameter of an alpha particle?

A 10^{-15} m **B** 10^{-12} m **C** 10^{-9} m **D** 10^{-6} m

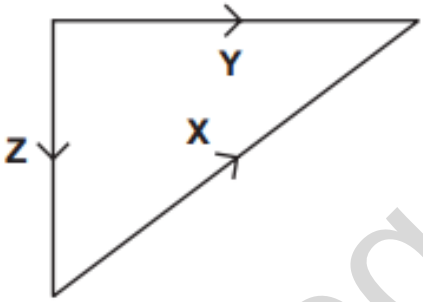
3 The diagram shows two vectors **X** and **Y**.



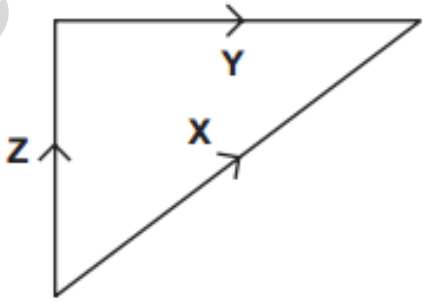


In which vector triangle does the vector **Z** show the magnitude and direction of vector **X–Y**?

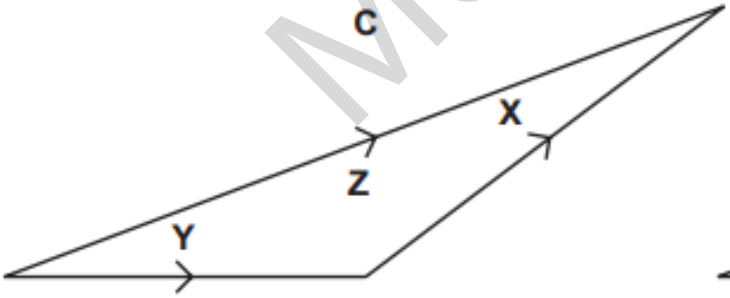
A



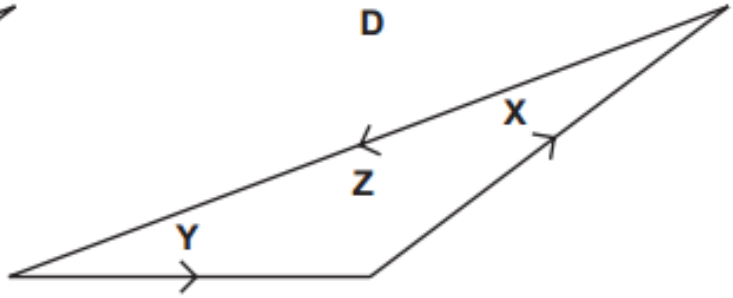
B



C



D



5 A mass m has acceleration a. It moves through a distance s in time t. The power used in accelerating the mass is equal to the product of force and velocity. The percentage uncertainties are

0.1% in m,

1% in a,

1.5% in s,

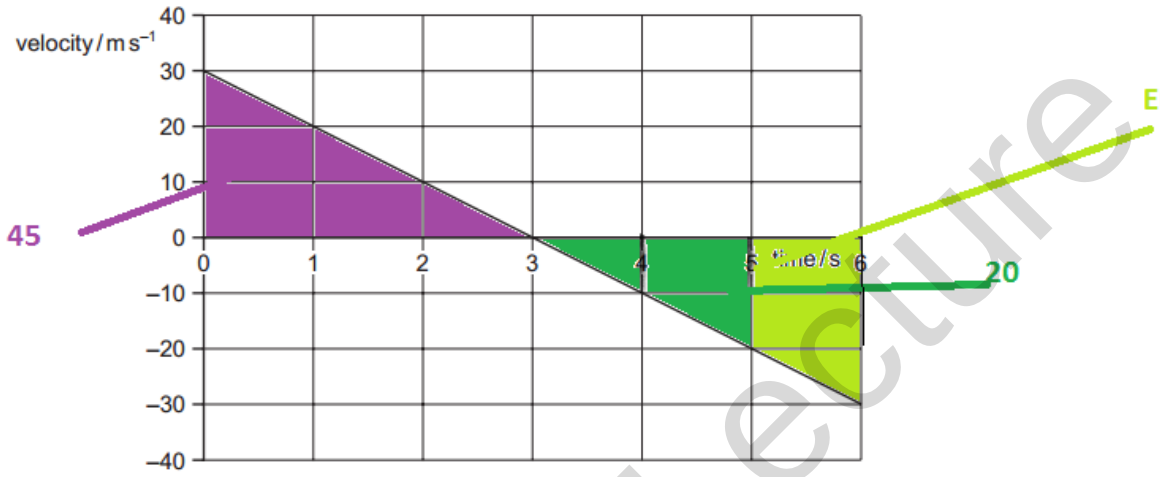
0.5% in t.

What is the percentage uncertainty in the average power?

A 2.1% **B** 2.6% **C** 3.1% **D** 4.1%

Add all the uncertainties

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



ENTIRE TRAINGLE = 45

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

Meticulous care should be taken while attempting the 'displacement' questions:
Area of the 2 sections of the graph is marked in the diagram^

Distance until 5 s = 45 + 20 = 65

Total DISTANCE = 45 + 45
= 90

90 - 65
= 25

15 A car of mass 1000 kg first travels forwards at 25 m s^{-1} and then backwards at 5 m s^{-1}.

What is the change in the kinetic energy of the car?

A 200 kJ **B** 300 kJ **C** 325 kJ **D** 450 kJ

Initial E.K = 1/2 (1000) (25^2)
= 312,500 J

Final E.K = 1/2 (1000) (5^2)
= 12,500 J

NOTE: THE VELOCITY FOR THE FINAL E.K WON'T BE NEGATIVE. IT WILL ONLY BE NEGATIVE WHEN THE OBJECT IS MOVING UP AND DOWN.

19 What is plastic deformation?

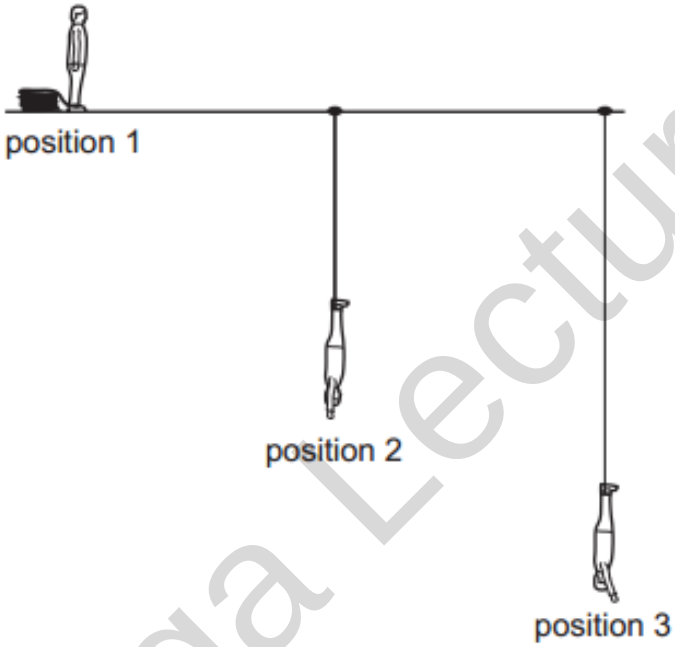
A Plastic deformation occurs when strain is not proportional to stress but when the load is removed the material returns to its original length.

B Plastic deformation occurs if, when the load is removed, the material contracts but a permanent stretching has occurred.

C Plastic deformation occurs until the extension is no longer proportional to the load.

D Plastic deformation occurs when the material extends so that strain is directly proportional to stress.

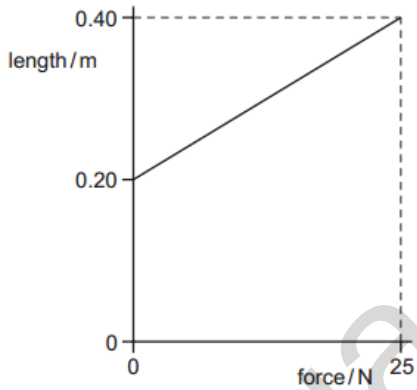
16 When bungee jumping, a student starts with maximum gravitational potential energy (position 1), then falls freely until the rope fully unwinds (position 2), after which the rope starts to stretch until the lowest point of the jump is reached (position 3).



What are the kinetic and elastic potential energies at position 3?

	kinetic energy	elastic potential energy
A	maximum	maximum
B	maximum	minimum
C	minimum	maximum
D	minimum	minimum

20 The graph shows how the length of a particular rubber cord varies as force is applied.



What is the maximum strain energy in this deformed rubber cord?

A 2.5 J **B** 5.0 J **C** 7.5 J **D** 10 J

The workdone will be calculated using the area under the straight line. But in this case, the extenstion is 0.20 m only. Thus the max strain energy will be

1/2 (25) (0.20)

= 2.5 J

2 At temperatures close to 0 K, the specific heat capacity c of a particular solid is given by $c = bT^3$, where T is the thermodynamic temperature and b is a constant characteristic of the solid.

What are the units of constant b, expressed in SI base units?

A $m^2 s^{-2} K^{-3}$

B $m^2 s^{-2} K^{-4}$

C $kg\,m^2 s^{-2} K^{-3}$

D $kg\,m^2 s^{-2} K^{-4}$

4 A student uses a digital ammeter to measure a current. The reading of the ammeter is found to fluctuate between 1.98 A and 2.02 A.

The manufacturer of the ammeter states that any reading has a systematic uncertainty of ± 1 %.

Which value of current should be quoted by the student?

A (2.00 ± 0.01) A

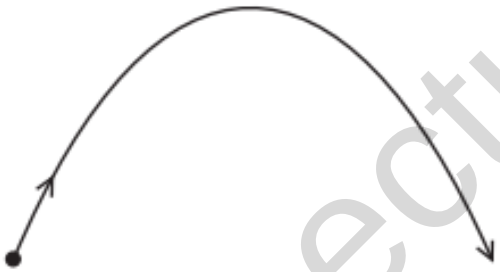
B (2.00 ± 0.02) A

C (2.00 ± 0.03) A

D (2.00 ± 0.04) A

The 1% systematic uncertainty needs to be added to the 1 % random uncertainty to get an overall 2 % uncertainty

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



Air resistance is negligible.

Why does the path have this shape?

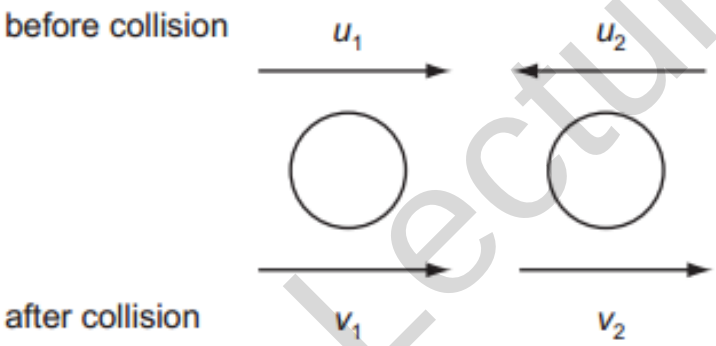
A The stone has a constant horizontal velocity and constant vertical acceleration.

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.

10 Two spheres approach each other along the same straight line. Their speeds are u_1 and u_2 before collision, and v_1 and v_2 after collision, in the directions shown below.



Which equation is correct if the collision is perfectly elastic?

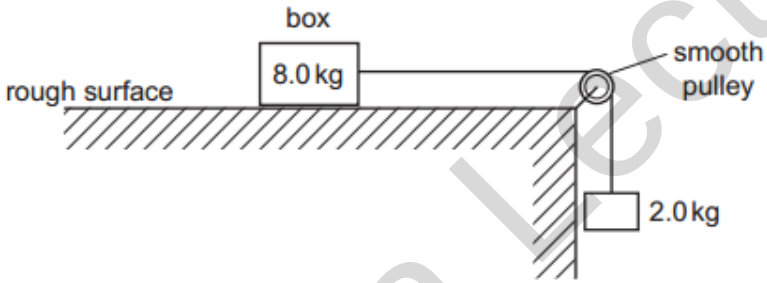
A $u_1 - u_2 = v_2 + v_1$

B $u_1 - u_2 = v_2 - v_1$

C $u_1 + u_2 = v_2 + v_1$

D $u_1 + u_2 = v_2 - v_1$

11 A box of mass 8.0 kg rests on a horizontal, rough surface. A string attached to the box passes over a smooth pulley and supports a 2.0 kg mass at its other end.



$9.82 + 6.0 = [(8.0) + (2.0)] * a$

When the box is released, a friction force of 6.0 N acts on it.

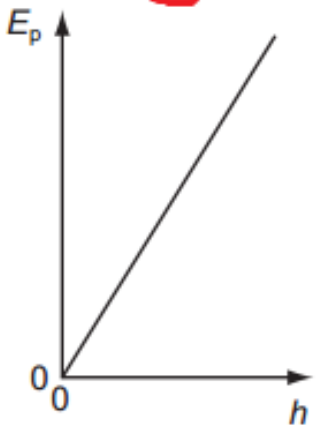
What is the acceleration of the box?

A $1.4\,m\,s^{-2}$ **B** $1.7\,m\,s^{-2}$ **C** $2.0\,m\,s^{-2}$ **D** $2.5\,m\,s^{-2}$

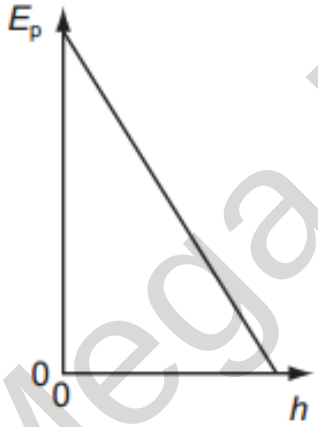
16 An object is thrown into the air.

Which graph shows how the potential energy E_p of the object varies with height h above the ground?

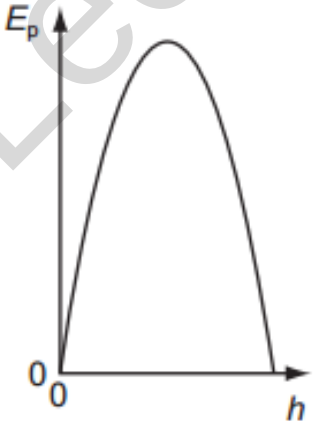
A



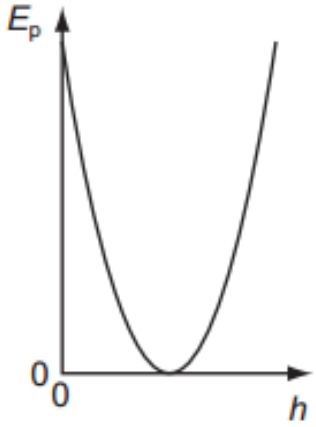
B



C



D



I9 Which properties best describe modelling clay?

A brittle and ductile

B ductile and elastic

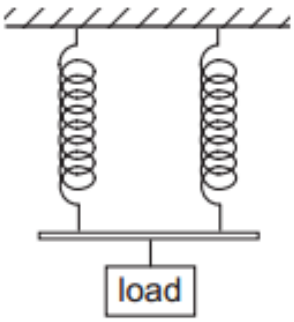
C elastic and plastic

D plastic and ductile

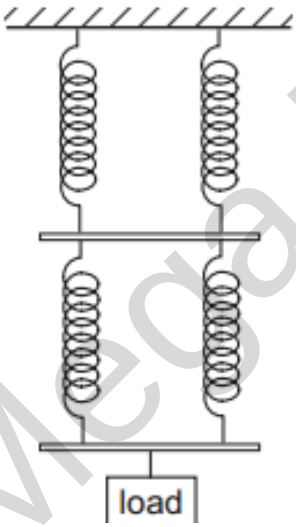
21 A number of similar springs, each having the same spring constant, are joined in four arrangements. The same load is applied to each.

Which arrangement gives the greatest extension?

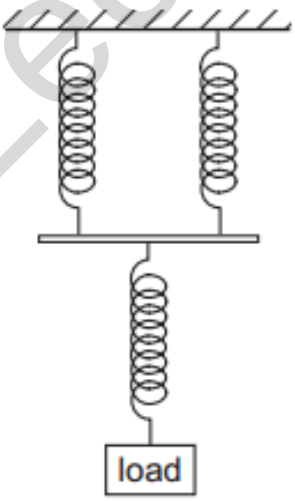
A



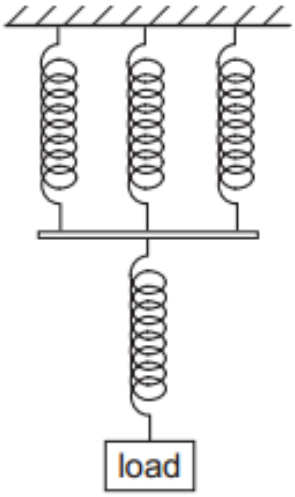
B



C



D



11 The diagrams show two ways of hanging the same picture.

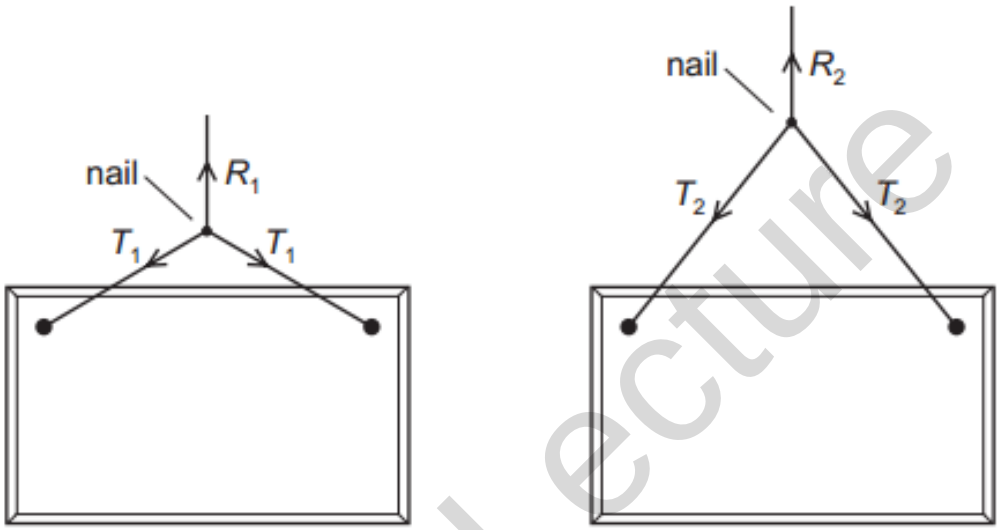


diagram 1 diagram 2

In both cases, a string is attached to the same points on the picture and looped symmetrically over a nail in a wall. The forces shown are those that act on the nail.

In diagram 1, the string loop is shorter than in diagram 2.

Which information about the magnitude of the forces is correct?

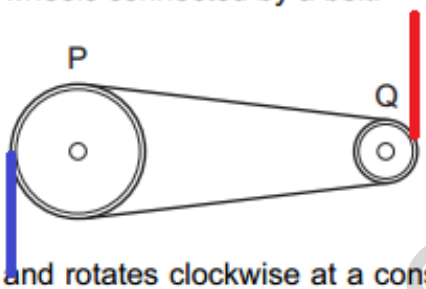
A $R_1 = R_2$ $T_1 = T_2$

B $R_1 = R_2$ $T_1 > T_2$

C $R_1 > R_2$ $T_1 < T_2$

D $R_1 < R_2$ $T_1 = T_2$

12 The diagram shows two pulley wheels connected by a belt.



Wheel Q is driven by a motor and rotates clockwise at a constant rate. Wheel Q puts tension in the top portion of the belt, which in turn drives the wheel P. The lower portion of the belt is slack and has no tension. The weight of the belt and frictional forces are negligible.

The diameter of P is 150 mm. The diameter of Q is 100 mm. The torque applied to Q is 3.0 N m.

What is the tension in the belt and the torque on wheel P?

	tension in top of belt / N	torque on wheel P / N m
A	20	2.0
B	30	4.5
C	40	2.0
D	60	4.5

Radius of Q = 100 / 2 = 50 mm = 0.05 m

3.0 = F * 0.05

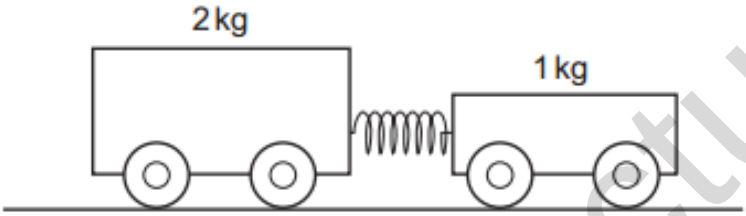
F = 60 N

13 A projectile is launched at 45° to the horizontal with initial kinetic energy E.

Assuming air resistance to be negligible, what will be the kinetic energy of the projectile when it reaches its highest point?

A $0.50E$ **B** $0.71E$ **C** $0.87E$ **D** E

14 Two trolleys are placed together on a horizontal runway with a compressed spring between them.



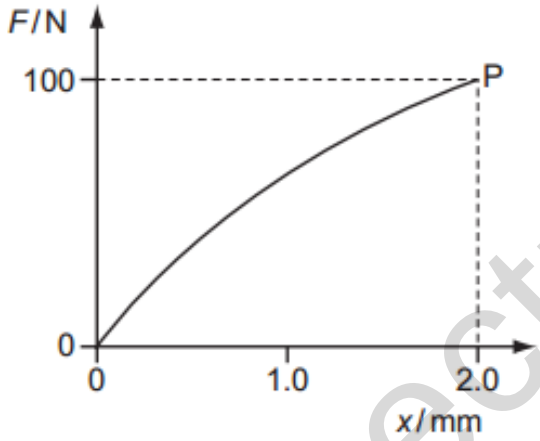
When they are released, the 2 kg trolley moves to the left at 2 m s^{-1}.

How much energy was stored in the spring?

A 4 J **B** 6 J **C** 8 J **D** 12 J

Velocity of small car can be calculated using the momentum formula = 4ms^-1
E.K of big car = 4 J
E.K of small car = 8 J
Energy stored in compressed spring converted in to E.K
Thus 4 + 8 = 12 J

20 The graph shows the non-linear force-extension curve for a wire made from a new composite material.



What could be the value of the strain energy stored in the wire when it is stretched to point P?

A 0.09 J **B** 0.10 J **C** 0.11 J **D** 0.20 J

Area under the graph = 1/2 (2.0 / 1000 NEED TO CONVERT IN TO M) (100)
= 0.10 J

However, since this is not linear, the value for it WILL ALWAYS BE 1% GREATER.

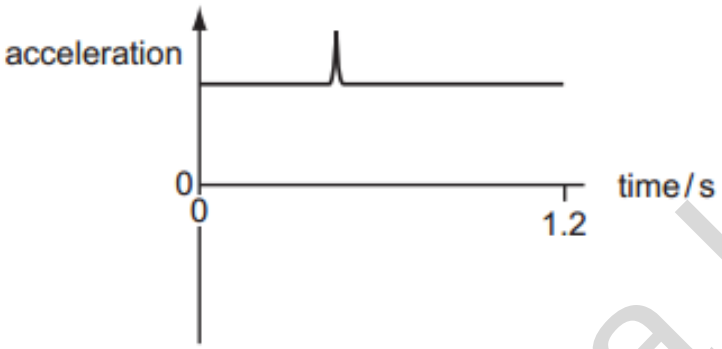
THUS
0.10 * (110 / 100)
= 0.11 J

7 A student throws a ball in the positive direction vertically upwards.

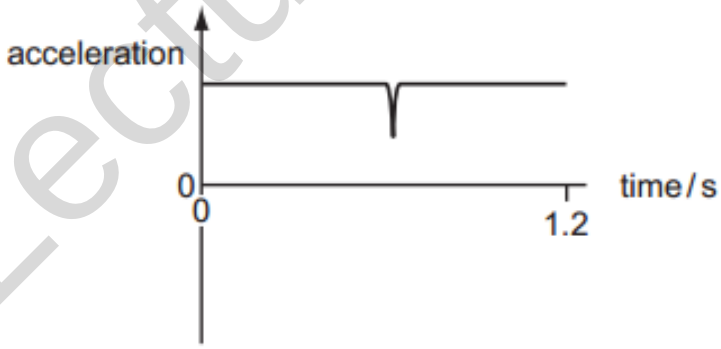
The ball makes an elastic collision with the ceiling, rebounds and accelerates back to the student's hand in a time of 1.2 s.

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?

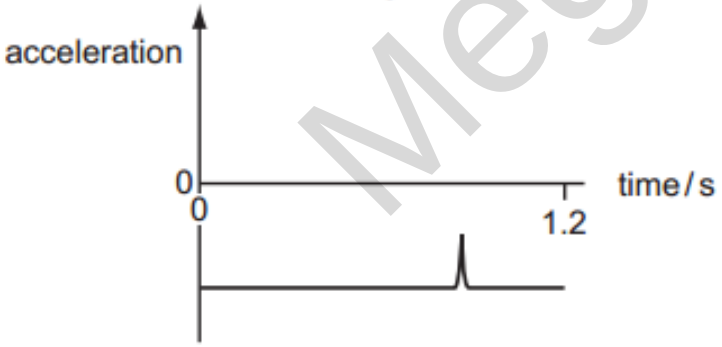
A



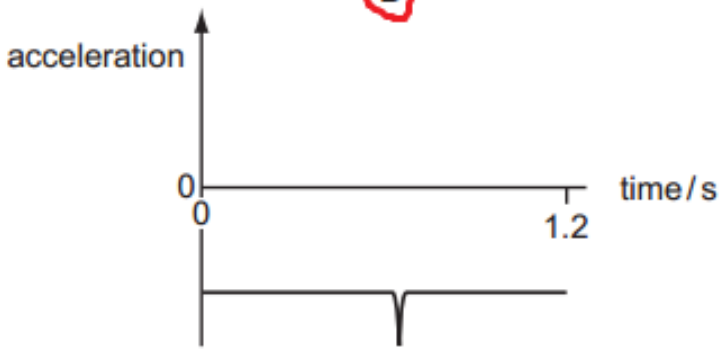
B



C



D



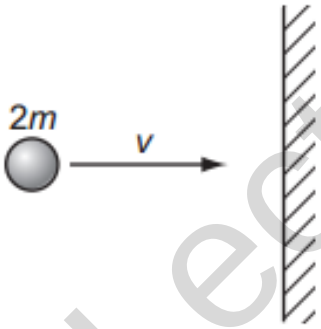
8 A moving body undergoes uniform acceleration while travelling in a straight line between points X, Y and Z. The distances XY and YZ are both 40 m. The time to travel from X to Y is 12 s and from Y to Z is 6.0 s.

What is the acceleration of the body?

A $0.37\,m\,s^{-2}$ **B** $0.49\,m\,s^{-2}$ **C** $0.56\,m\,s^{-2}$ **D** $1.1\,m\,s^{-2}$

When drawing the graphical representation of the information, find the acceleration from the second part of the motion.

9 A particle of mass $2m$ and velocity v strikes a wall.



The particle rebounds along the same path after colliding with the wall. The collision is inelastic.

What is a possible change in the momentum of the ball during the collision?

A mv **B** $2mv$ **C** $3mv$ **D** $4mv$

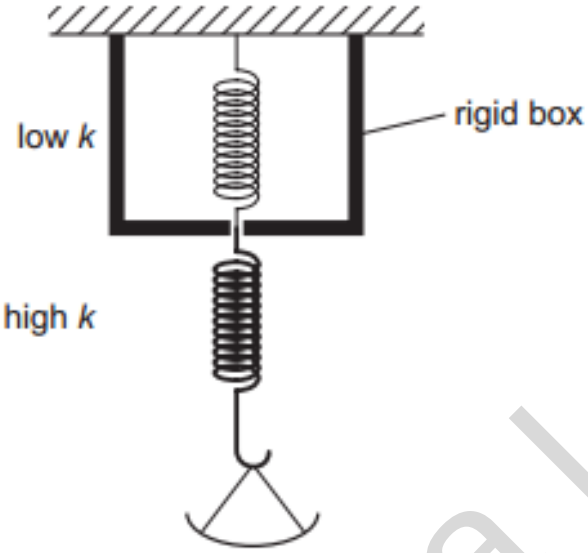
The collision is inelastic. Some of the energy will be lost, to cause the body to move with a velocity less than "v" on the rebound

22 To determine the mass of food in a pan, a scale is used that has high sensitivity for small masses but low sensitivity for large masses.

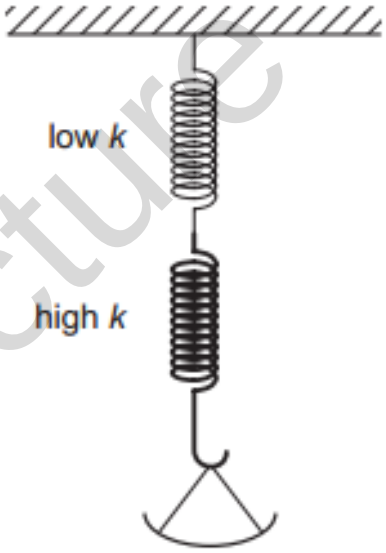
To do this, two springs are used, each with a different spring constant *k*. One of the springs has a low spring constant and the other has a high spring constant.

Which arrangement of springs would be suitable?

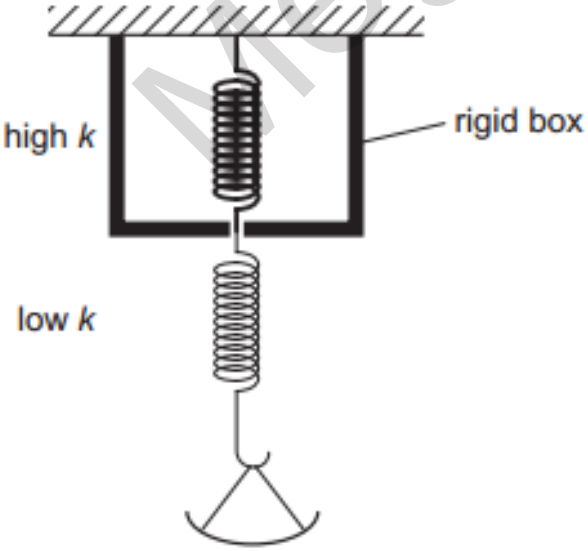
A



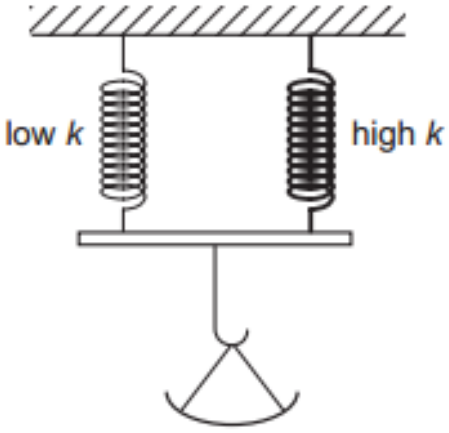
B



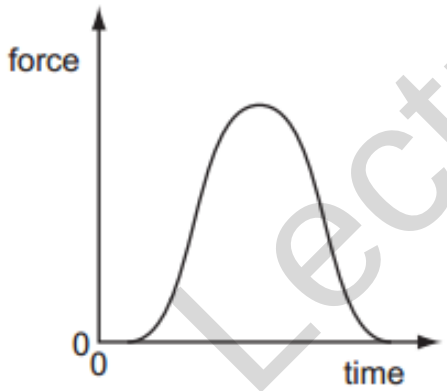
C



D



9 A golf ball is hit by a club. The graph shows the variation with time of the force exerted on the ball by the club.



Which quantity, for the time of contact, **cannot** be found from the graph?

A the average force on the ball

B the change in momentum of the ball

C the contact time between the ball and the club

D the maximum acceleration of the ball

10 A group of students investigating the principle of conservation of momentum use a small truck travelling over a frictionless surface.

Sand is dropped into the truck as it passes X. At Y, a trapdoor in the bottom of the truck opens and the sand falls out.

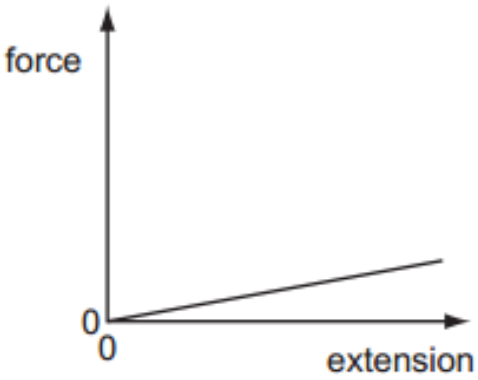
How does the velocity of the truck change when the sand is added to the truck at X and then leaves the truck at Y?

	at X	at Y
A	decreases	increases
B	decreases	stays the same
C	stays the same	increases
D	stays the same	stays the same

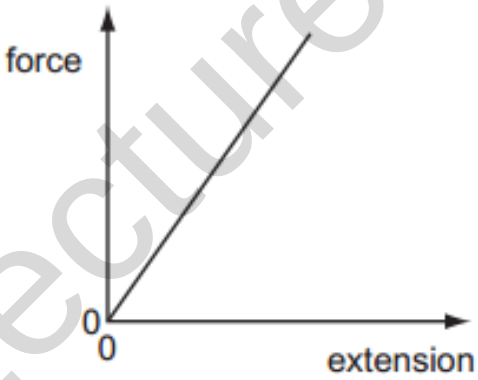
23 The following force-extension graphs are drawn to the same scale.

Which graph represents the deformed object with the greatest amount of elastic potential energy?

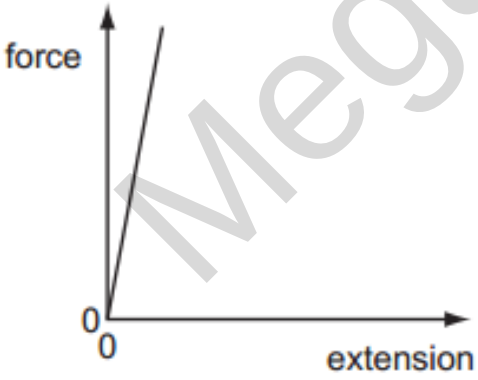
A



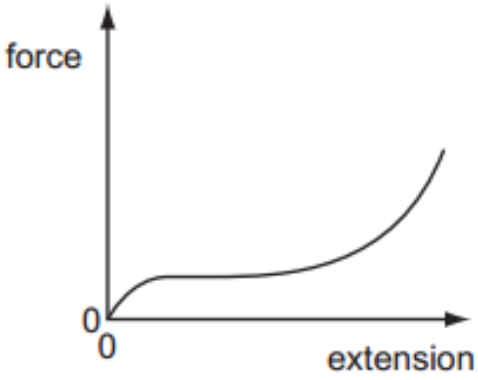
B



C



D

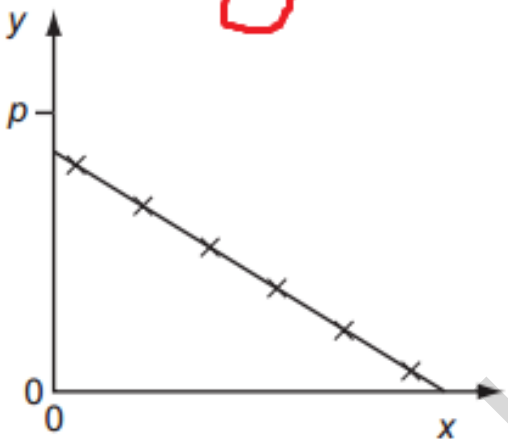


6 Variables x and y are related by the equation $y = p - qx$ where p and q are constants.

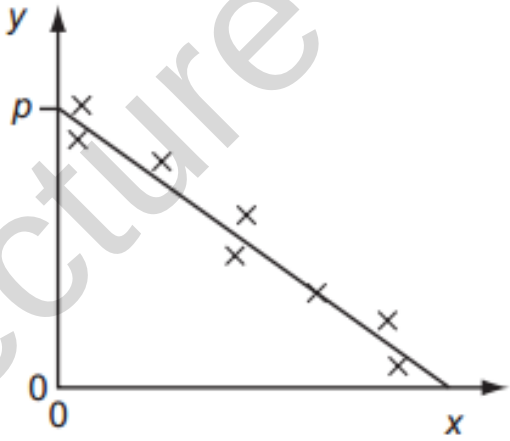
Values of x and y are measured experimentally. The results contain a systematic error.

Which graph best represents these results?

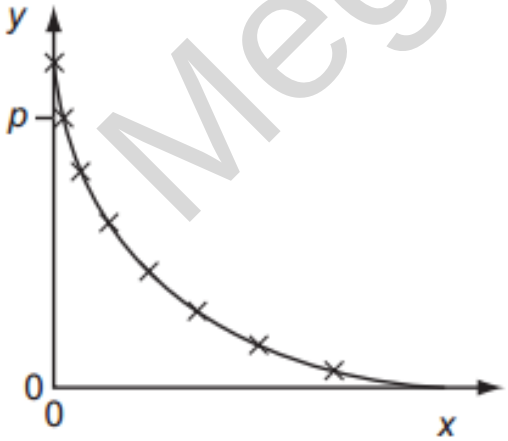
A



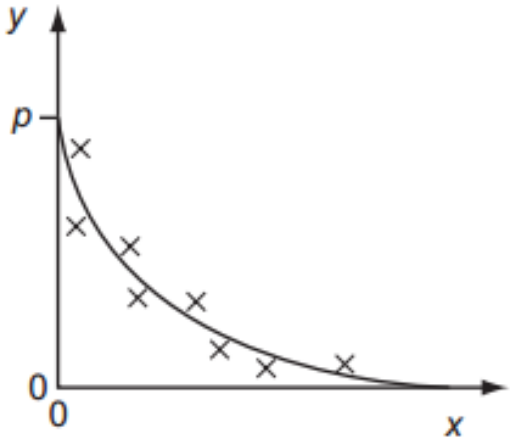
B



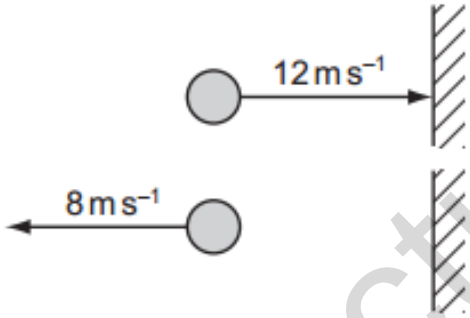
C



D



12 A ball of mass 0.5 kg is thrown against a wall at a speed of 12 m s^{-1}. It bounces back with a speed of 8 m s^{-1}. The collision lasts for 0.10 s.



What is the average force on the ball due to the collision?

A 0.2 N **B** 1 N **C** 20 N **D** 100 N

$v - u = a * t$

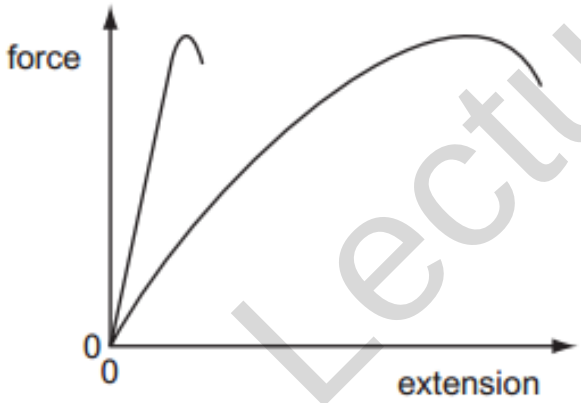
$12 - (-8) = a * 0.10$

$a = 200\ ms^{-2}$

$F = m * a$

$F = 0.5 * 200 = 100\ N$

26 The diagram shows the force-extension graphs for two materials, of the same dimensions, loaded to fracture.



What describes the behaviour of the materials?

A Both materials are brittle.

B Both materials obey Hooke's law.

C Both materials are plastic.

D Both materials have the same ultimate tensile stress.