Physical Sciences

Grade 12

Paper 1 (Physics)

190

Multiple-Choice Questions

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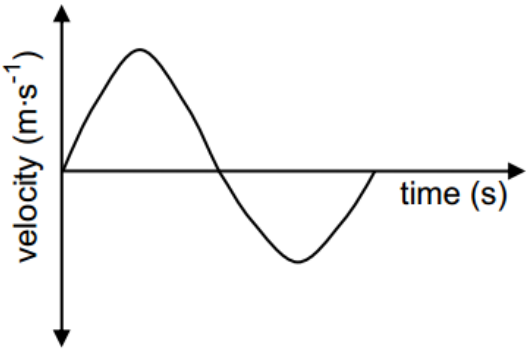
Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the best answer and write down **A**, **B**, **C** or **D** next to the question number (1.1 to 9.26) on your ANSWER BOOK. ***Enjoy!***

QUESTION 1 (VERTICAL PROJECTILE MOTION)

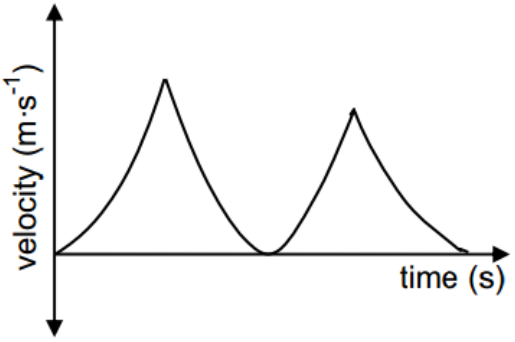
1.1 A ball is released from rest from a certain height above the floor and bounces off the floor a number of times. Ignore the effects of air resistance.

Which ONE of the following velocity-time graphs best represents the motion of the ball?

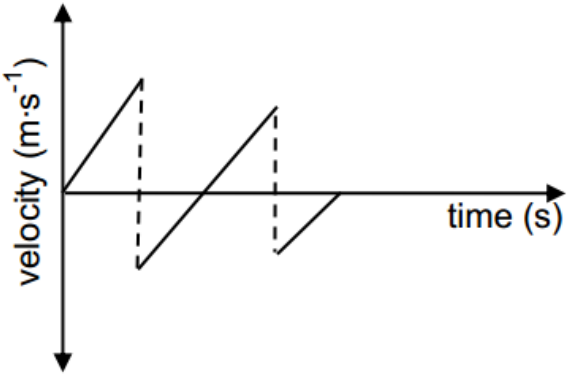
A



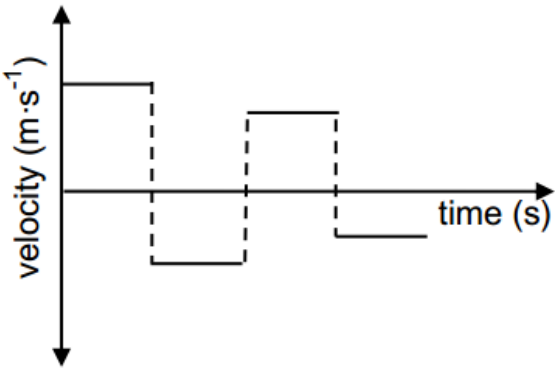
B



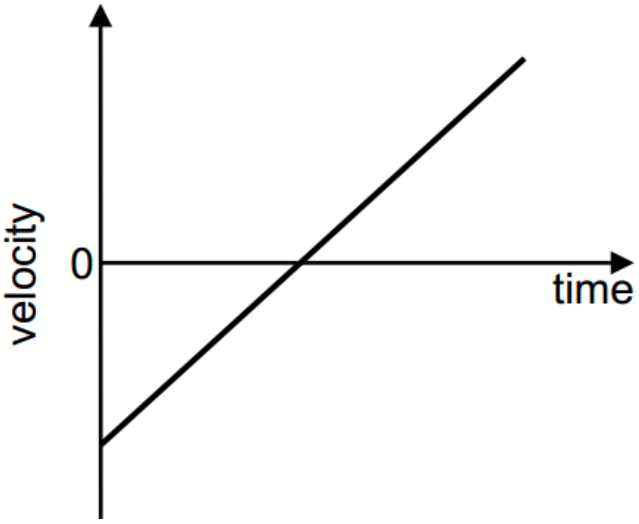
C



D

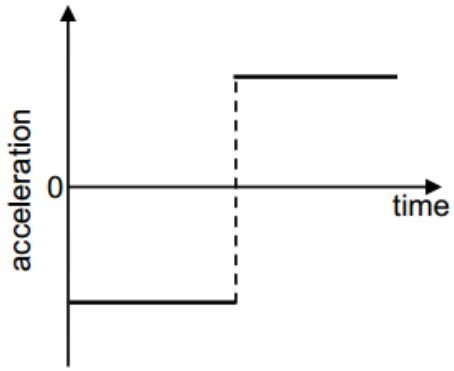


1.2 The velocity-time graph below represents the motion of an object.

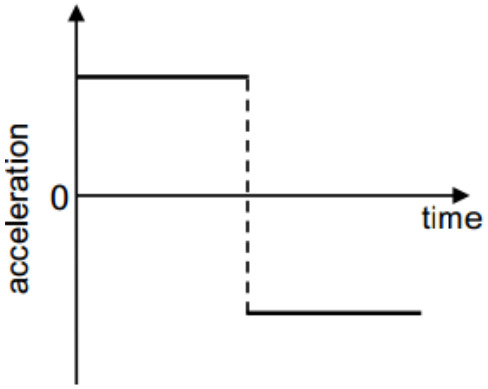


Which ONE of the following graphs represents the corresponding acceleration-time graph for the motion of this object?

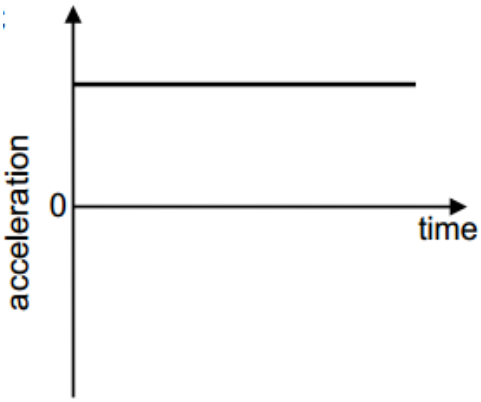
A



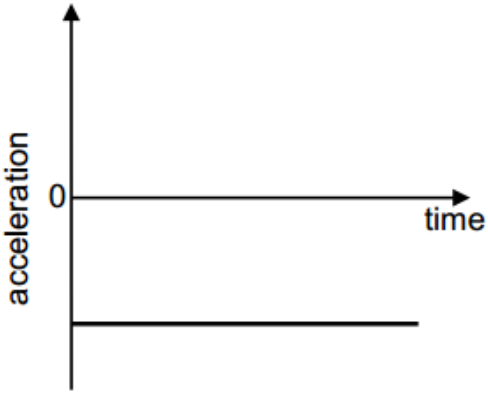
B



C



D



1.3 A ball is thrown vertically upwards. Which ONE of the following physical quantities has a non-zero value at the instant the ball changes direction?

A Acceleration

B Kinetic energy

C Momentum

D Velocity

1.4 If air resistance is negligible, the total mechanical energy of a free-falling body …

A remains constant.

B becomes zero.

C increases.

D decreases.

1.5 An object is thrown vertically upwards. Which ONE of the following regarding the object's velocity and acceleration at the highest point of its motion is CORRECT? Ignore the effects of friction.

	VELOCITY	ACCELERATION
A	Zero	Zero
B	Zero	Upwards
C	Maximum	Zero
D	Zero	Downwards

1.6 The acceleration due to gravity on the Earth is g. What is the acceleration due to gravity on a planet which has double the mass of the Earth and half the radius of the Earth?

A 8 g

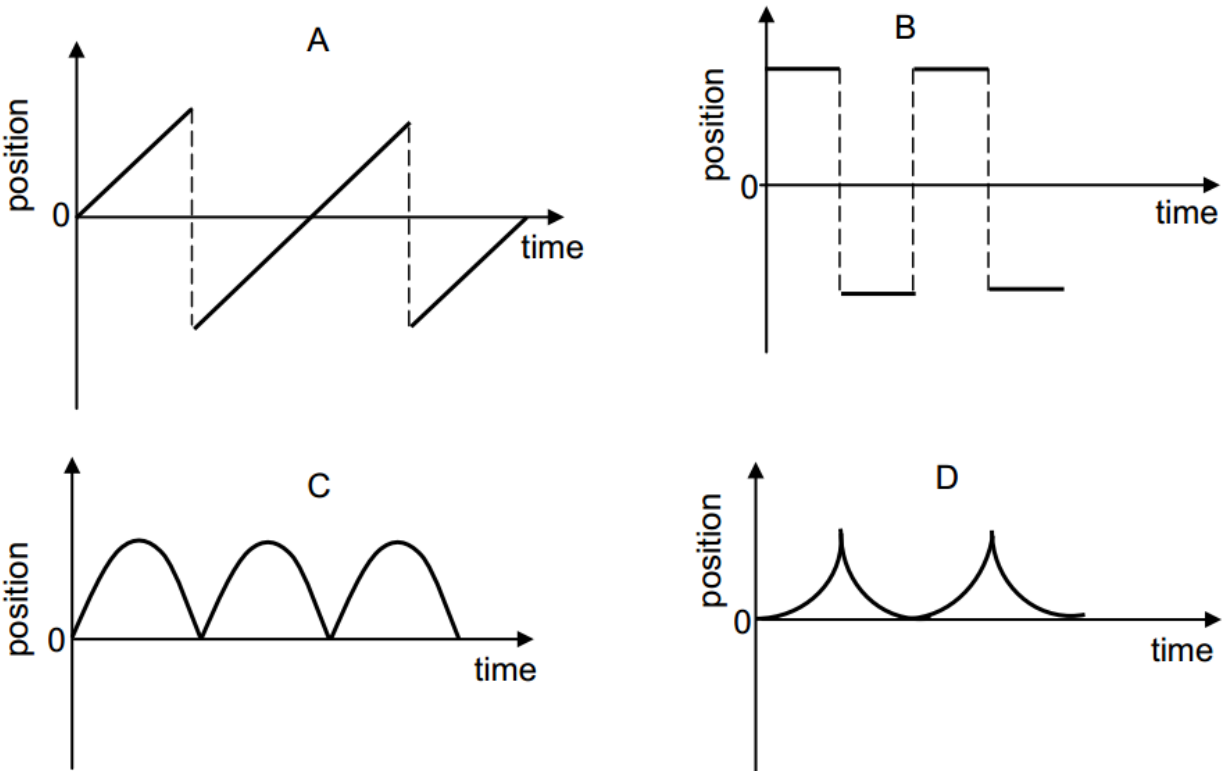
B 4 g

C 2 g

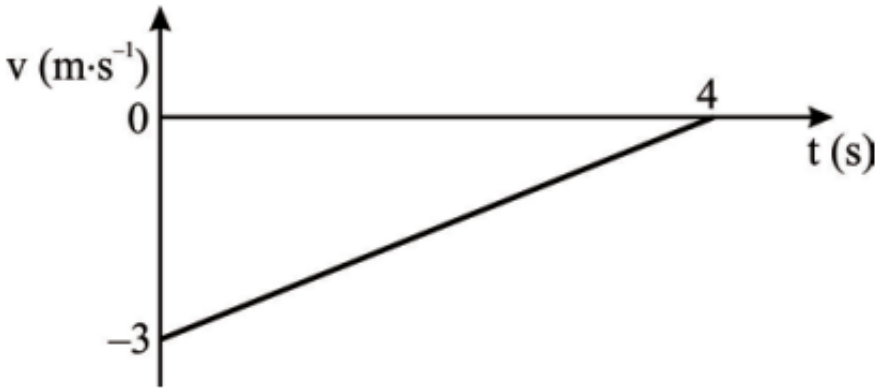
D ½ g

1.7 A ball is released from a height above the floor. The ball falls vertically and bounces off the floor a number of times. Ignore the effects of friction and assume that the collision of the ball with the floor is elastic. Take the point of release of the ball as the reference point and downward direction as positive.

Which ONE of the following is a CORRECT representation of the position-time graph for the motion of the ball?



1.8 A sketch of the velocity-time graph for a moving object is shown below.



Which answer best describes the magnitude of the object's velocity and the sign of the acceleration?

	VELOCITY ($\mathbf{m \cdot s^{-1}}$)	ACCELERATION ($\mathbf{m \cdot s^{-2}}$)
A	Decreasing	+
B	Decreasing	-
C	Increasing	+
D	Increasing	-

1.9 A ball is thrown vertically upwards. Which **ONE** of the following physical quantities of the ball will be **ZERO** when the ball reaches its maximum height?

A kinetic energy

B gravitational potential energy

C acceleration

D weigh

1.10 Acceleration due to gravity (g), at a particular point, on earth is 9,8 $\mathrm{m \cdot s^{-2}}$. If the radius of the earth were to be **halved** and its mass were to remain the same, then the acceleration due to gravity will be:

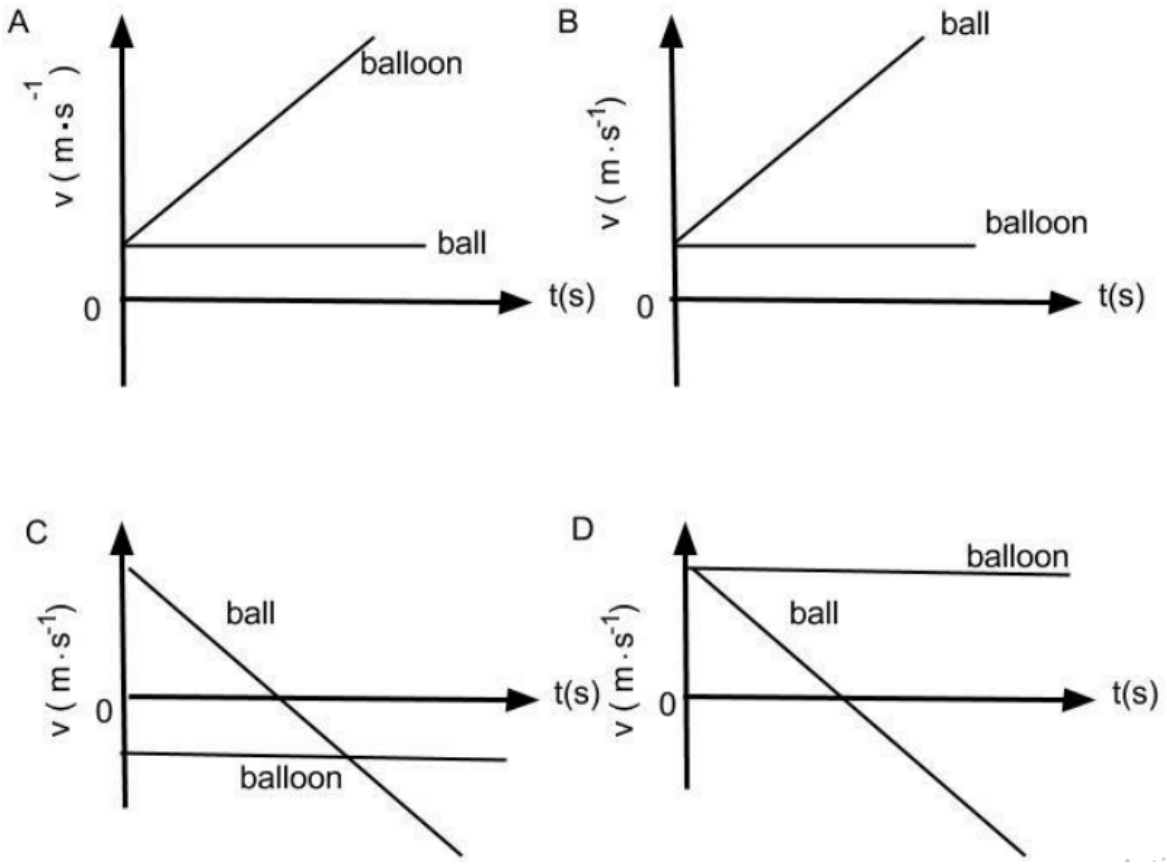
A 4,9 $\mathrm{m \cdot s^{-2}}$

B 9,8 $\mathrm{m \cdot s^{-2}}$

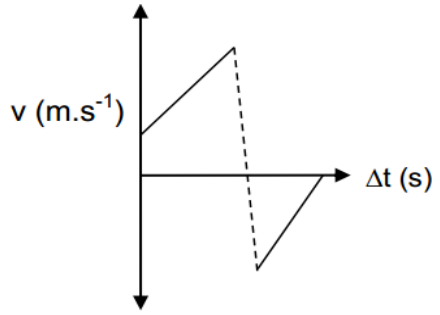
C 19,6 $\mathrm{m \cdot s^{-2}}$

D 39,2 $\mathrm{m \cdot s^{-2}}$

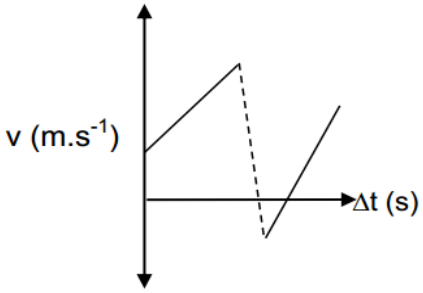
1.11 A ball is dropped from a hot air balloon that is ascending at a constant velocity. Take UPWARDS as the POSITIVE direction. The correct velocity vs time graph for the motion of the ball and the balloon is:



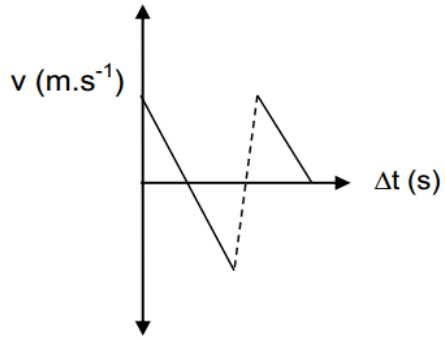
1.12 An object is thrown vertically downwards towards the ground from height *h* with a velocity *v.* The object strikes the ground and bounces upwards. It is caught when it reaches its maximum height after the bounce. Which ONE of the following velocity versus time graphs best represents the motion of the object?



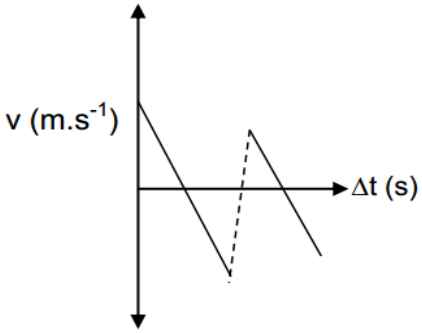
A



B

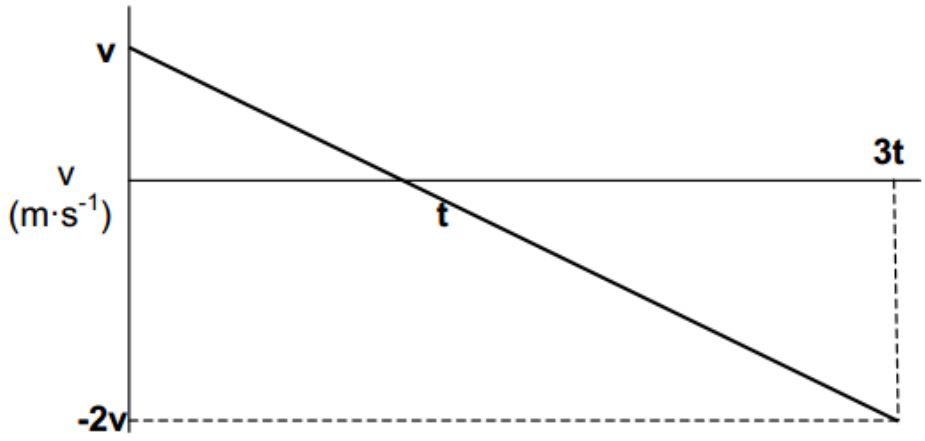


C



D

1.13 The velocity versus time graph below represents the movement of an object under the influence of gravitational force.
The displacement of the object in time **3t** is …



A **vt**.

B zero.

C **-vt**.

D $-\frac{3}{2}$ **vt**.

1.14 An object is freely falling towards the surface of the earth.

Which ONE of the following best describes the direction of the **acceleration** of the object?

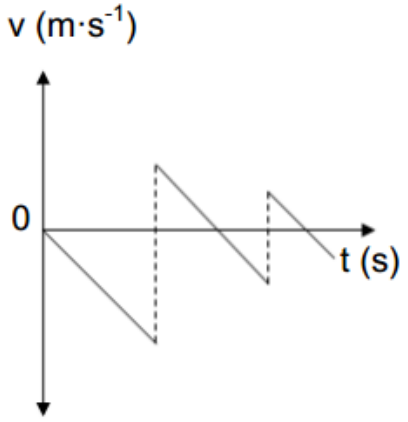
A The acceleration is 9,8 $\mathrm{m \cdot s^{-2}}$ downward.

B The acceleration is 9,8 $\mathrm{m \cdot s^{-2}}$ upward.

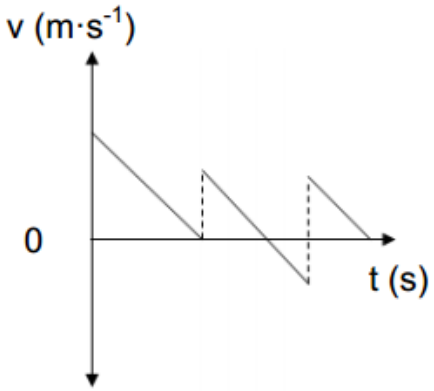
C The acceleration is less than 9,8 $\mathrm{m \cdot s^{-2}}$ downward.

D The acceleration is less than 9,8 $\mathrm{m \cdot s^{-2}}$ upward.

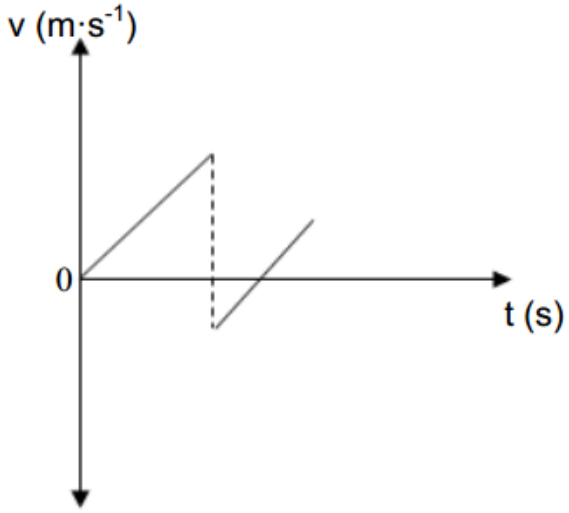
1.15 A ball is dropped from a height. Which ONE of the following velocity vs time graphs best represents the motion of the ball dropped and then bouncing vertically upwards twice?



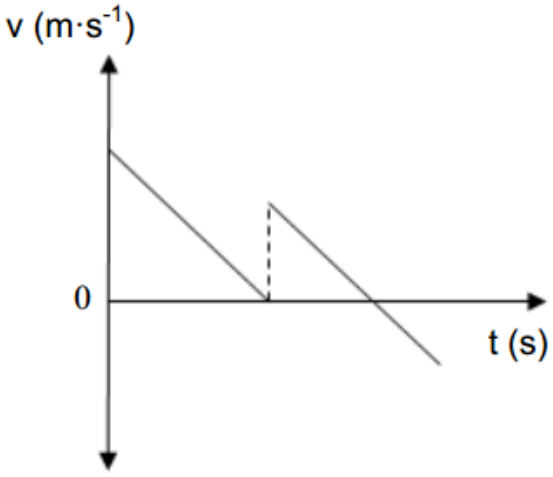
A



B



C



D

USE THE INFORMATION BELOW TO ANSWER QUESTIONS 1.16 AND 1.17.

An object is thrown upwards with a velocity of 5 $\mathrm{m} \cdot \mathrm{s}^{-1}$. Ignore the effects of air friction.

1.16 Which ONE of the following gives the magnitude of the velocity of the object at its maximum height?

A 0

B 5

C 4,9

D 9.8

1.17 The height reached by the object when its velocity is 2 $\mathrm{m} \cdot \mathrm{s}^{-1}$ can be determined in ONE single step. The equation below that can be used to find this is…

A $v_f = v_i + g\Delta t$

B $v_f^2 = v_i^2 + 2g\Delta y$

C $\Delta y = v_i\Delta t + \frac{1}{2}g\Delta t^2$

D $\Delta y = (\frac{v_i+v_f}{2})\Delta t$

1.18 The statements below describe the motion of objects.

(i) A feather falls from a certain height inside a vacuum tube.

(ii) A box slides along a smooth horizontal surface at constant speed

(iii) A steel ball falls through the air in the absence of air friction.

Which of the following describes UNIFORMLY ACCELERATED motion CORRECTLY?

A (i) and (ii) only

B (i) and (iii) only

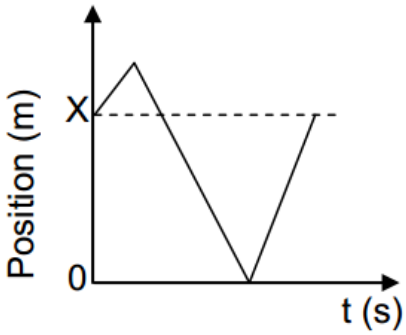
C (ii) and (iii) only

D (i), (ii) and (iii)

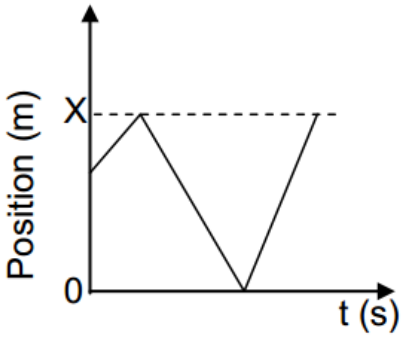
1.19 A ball is projected vertically upwards from a *height X above the ground*. After some time, the ball falls to the ground and bounces back to the same height from which it was projected. Ignore friction and assume that there is a negligible time lapse during the collision of the ball with the ground.

Which ONE of the following is the CORRECT position-time graph for the motion of the ball as described above?

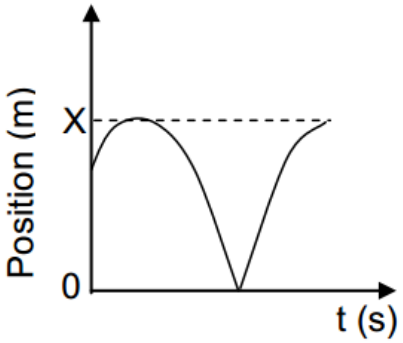
A



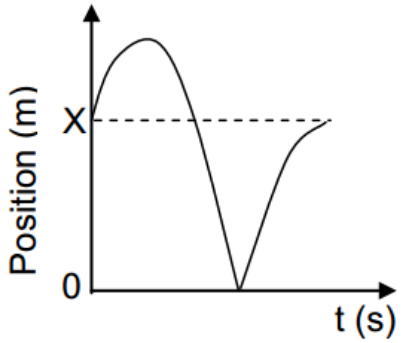
B



C



D



1.20 An object is thrown vertically upwards from the ground.

Which ONE of the following is CORRECT regarding the direction of the acceleration of the object as it moves upwards and then downwards? Ignore the effects of air resistance.

	OBJECT MOVING UPWARDS	OBJECT MOVING UPWARDS
A	Downwards	Upwards
B	Upwards	Downwards
C	Downwards	Downwards
D	Upwards	Upwards

1.21 A training machine shots a tennis ball vertically upwards from the ground with a velocity of **v** and takes 3 seconds to reach maximum height. Ignore the effects of friction. TWO seconds before it reaches its maximum height above the ground, the magnitude of its velocity is …

A $4.9\ \mathrm{m \cdot s^{-1}}$.

B $19.6\ \mathrm{m \cdot s^{-1}}$.

C $9.8\ \mathrm{m \cdot s^{-1}}$.

D $10\ \mathrm{m \cdot s^{-1}}$

1.22 A ball is dropped from rest at a height above the ground and reaches a velocity **v** after it has travelled a distance 2**y**. What will the magnitude of the velocity of the object be after it has travelled a distance 8**y**? (Ignore all effects of friction.)

A ½ **v**

B $\sqrt{2}$ **v**

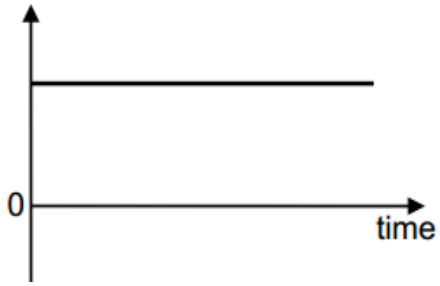
C 2**v**

D 4**v**

USE THE FOLLOWING INFORMATION TO ANSWER QUESTIONS 1.23 AND 1.24.

“A learner drops a ball from the top of a building.”

1.23 The graph for the motion is shown below.



Which ONE of the following physical quantities could be represented on the y-axis of the graph below, indicating the ball is in the air?

A Momentum

B Acceleration

C Displacement

D Potential energy

1.24 After falling a certain distance **d**, the ball’s kinetic energy is proportional to…

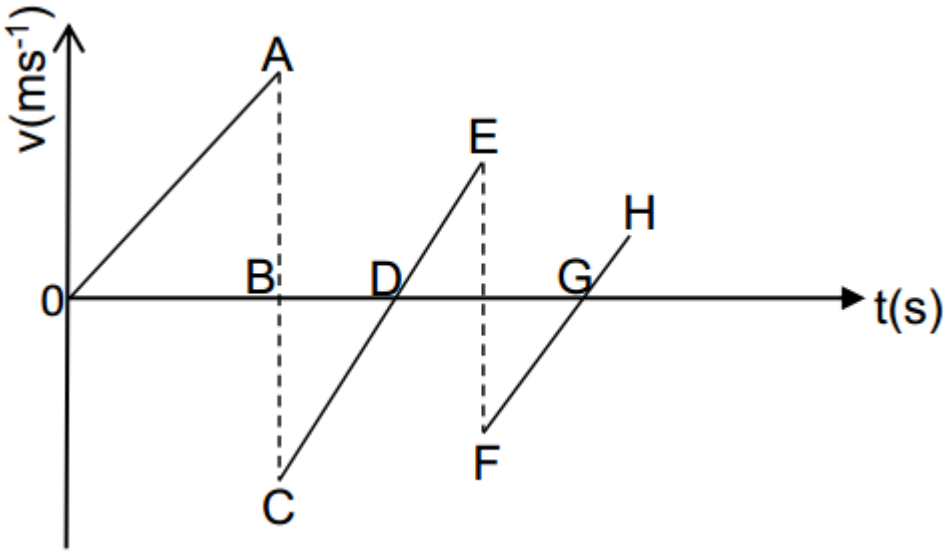
A $\mathbf{d}$

B $\mathbf{d^2}$

C $\sqrt{\mathbf{d}}$

D $\frac{\mathbf{1}}{\mathbf{d^2}}$

1.25 A ball is released from rest from a certain height above the ground and bounces off several times. The velocity – time graph below represents the motion of the bouncing ball from the instant it is released from rest.



Neglecting air resistance, which point (**B, D, E or G**) on the graph, represents the maximum height reached by the ball after the SECOND BOUNCE?

A D

B E

C B

D G

QUESTION 2 (MOMENTUM & IMPULSE)

2.1 Which of the following physical quantities is equal to the product of net force and change in time?

A Power

B Impulse

C Energy

D Work

2.2 A cricketer hits an approaching ball back in the opposite direction to its original direction.

Which ONE of the following statements regarding this collision between the bat and the ball is TRUE?

A The collision is perfectly elastic.

B The momentum of the ball stays the same before and after the collision.

C The magnitude of the net force of the ball on the bat is equal to the magnitude of the net force of the bat on the ball.

D The magnitude of the net force of the bat on the ball is greater than the magnitude of the net force of the ball on the bat.

2.3 Which ONE of the following is the unit of measurement for the **rate of change of momentum**?

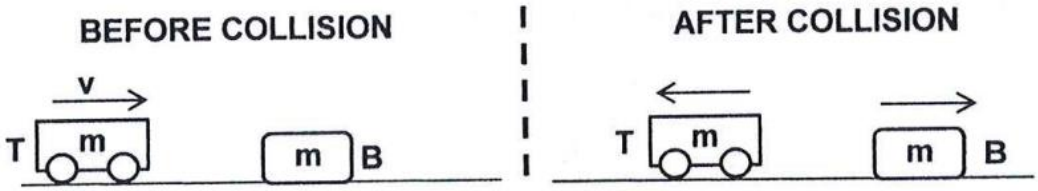
A Ampere

B Coulomb

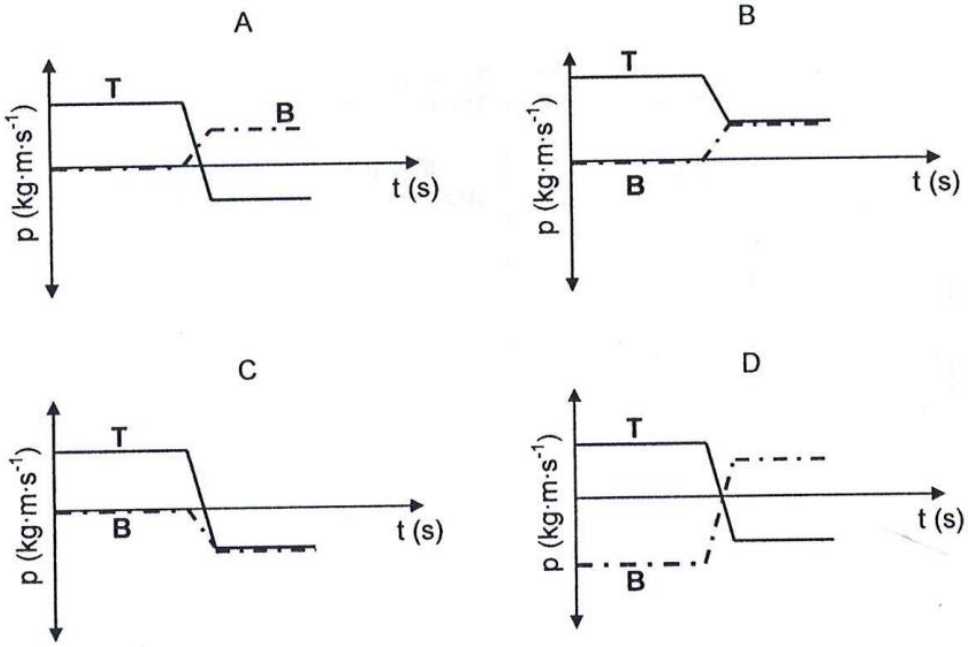
C Newton

D Watt

2.4 A trolley **T** with mass **m** moves on a frictionless horizontal surface to the right at a constant speed **v**. The trolley collides against a stationary block **B** with the same mass **m**. After the collision the trolley moves to the left.



Which ONE of the following **p** versus **t** graph is the CORRECT representation of the momentum of trolley and block *before* and *after* the collision?



2.5 Which ONE of the following statement about linear momentum is TRUE?

Momentum…

A is a force

B of an object is always positive.

C is a scalar quantity.

D and impulse have the same units.

2.6 Which ONE of the following statements is always TRUE for inelastic collisions in an isolated system?

A Both momentum and kinetic energy are conserved.

B Both momentum and kinetic energy are not conserved.

C Momentum is conserved, but not kinetic energy.

D Kinetic energy is conserved, but not momentum.

2.7 Two spring-loaded trolleys of equal mass are “exploded” by releasing their springs simultaneously. Immediately after the explosion the trolleys move in opposite directions with equal velocity.

Which ONE of the following statements is correct regarding the moving apart of the trolleys?

A In an isolated system, the total momentum is conserved.

B The net force equals the product of the mass and velocity.

C Momentum equals the product of the mass and velocity.

D Impulse equals the product of the net force and collision time.

2.8 An airbag can protect a driver from serious injury during a collision.

Which ONE of the following best explains why this is possible?

	TIME OF IMPACT	**NET FORCE**
A	Increases	Increases
B	Decreases	Decreases
C	Increases	Decreases
D	Remains the same	Decreases

2.9 A ball with mass m, travelling west, hits a wall with a velocity of v. It bounces back with a velocity 0,75v an easterly direction. The change in momentum of the ball will be …

A 0,25 mv east

B 0,25 mv west

C 1,75 mv east

D 1,75 mv west

2.10 Two identical bullets, X and Y, with identical velocities strokes a steel block and a wooden block respectively.

Bullet X bounces 180^o back from the steel block. Bullet Y penetrates and becomes embedded inside the wooden block.

Which one of the following statements about the impulse of the bullets is correct?

Impulse of bullet **X**…

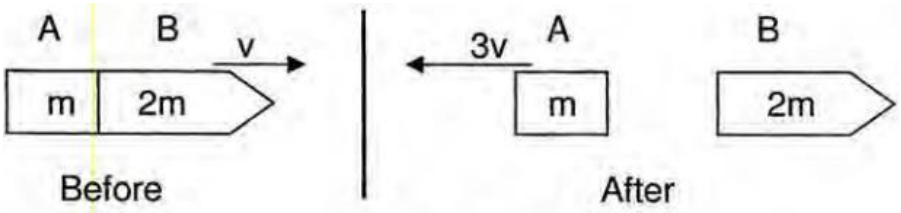
A is smaller than the impulse of bullet **Y.**

B is greater than the impulse of bullet **Y.**

C is equal to the impulse of bullet **Y.**

D and bullet **Y** are zero.

2.11 A spacecraft, consisting of two parts **A** and **B,** with masses **m** and **2m** respectively, is moving with a velocity in an easterly direction. After an explosion, part **A** breaks away from part **B** with a velocity of **3v** in a westerly direction as shown below.



The magnitude of the velocity of part **B** after the collision is …

A **v**

B **2v**

C **3v**

D **6v**

2.12 The magnitude of the impulse on a ball bouncing off a wall is equal to the ...

A net force of the ball on the wall.

B product of the net force on the ball and the time it acts.

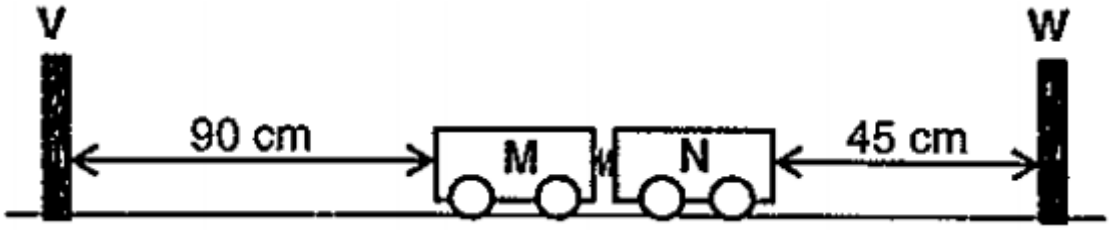
C change in velocity of the ball.

D product of the mass and the acceleration of the ball.

2.13 A body moving at a constant velocity has kinetic energy **E** and momentum **p**. The velocity of the body is doubled. Which ONE of the following correctly gives the magnitudes of both the kinetic energy and momentum?

	Kinetic Energy	Momentum
A	2 **E**	2 **p**
B	4 **E**	4 **p**
C	4 **E**	2 **p**
D	2 **E**	4 **p**

2.14 Two trolleys M and N are at rest on a frictionless surface. The compressed spring between the two trolleys is released and the trolleys move away from each other. The trolleys reach the buffers V and W SIMULTANEOUSLY. Which ONE of the following states the correct relationship between the magnitudes of the force on the two trolleys, change in momentum and acceleration in the two trolleys?



	Magnitude of force	Magnitude of change in momentum	Magnitude of acceleration
A	$F_M = F_N$	$\Delta p_M = \Delta p_M$	$a_M > a_N$
B	$F_M > F_N$	$\Delta p_M > \Delta p_M$	$a_M < a_N$
C	$F_M < F_N$	$\Delta p_M < \Delta p_M$	$a_M < a_N$
D	$F_M = F_N$	$\Delta p_M > \Delta p_M$	$a_M = a_N$

2.15 A toy gun is fixed to a small cart and both move to the right with speed **v** along a straight track, as shown below. When the gun fires a bullet, the cart with the gun is brought to rest. If **M** is the mass of the cart and the gun combined, and **m** is the mass of the bullet, what is the speed of the bullet immediately after it is fired?



A $\frac{\mathbf{Mv}}{\mathbf{m}}$

B $\frac{\mathbf{mv}}{\mathbf{M-m}}$

C $\frac{\mathbf{(M+m)v}}{\mathbf{m}}$

D $\frac{\mathbf{(M+m)v}}{\mathbf{m}}$

2.16 Which ONE of the following statements is equivalent to Newton Second Law of Motion? The net force experienced by an object is equivalent to…

A the rate of change of momentum of that object.

B the change in momentum of that object.

C the impulse experienced by the object.

D the momentum of that object.

2.17 If the total momentum of a system is changing:

A particles of the system must be exerting forces on each other

B the system must be under the influence of gravity

C the system must move at constant velocity

D a net external force must be acting on the system

2.18 A person drops a glass bottle onto a concrete floor from a certain height and the bottle breaks. The person then drops a second, identical glass bottle from the same height onto a thick, woollen carpet, but the bottle does not break.

Which ONE of the following is CORRECT for the second bottle compared to the first bottle for the same momentum change?

	AVERAGE FORCE ON SECOND BOTTLE	TIME OF CONTACT WITH CARPET
A	Larger	Smaller
B	Smaller	Smaller
C	Larger	Larger
D	Smaller	Larger

2.19 The **same force** is applied to trolley A and trolley B as shown in the sketch below.



The mass of A is **TWICE** the mass of B. If the rate of change of momentum of A is **x**, then the rate of change of momentum of B will be:

A ½ **x**

B **x**

C 2**x**

D 4**x**

2.20 The front of a modern car is designed to crumble in case of a head-on collision. The chance of serious injuries to the passenger is reduced because the …

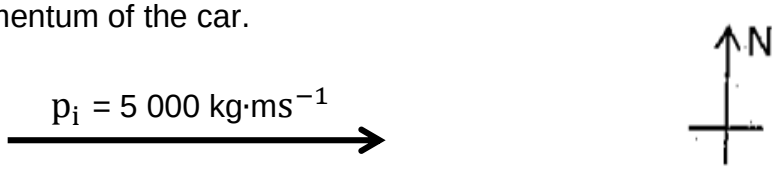
A net force acting on the passenger is reduced, since the contact time for the car to stop decreases.

B net force acting on the passenger is reduced, since the rate of change in momentum decreases.

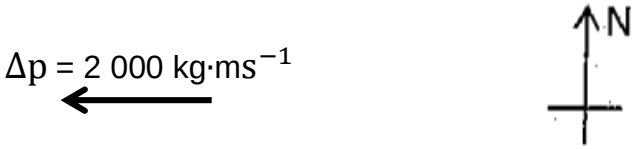
C net force acting on the passenger is reduced, since the change in momentum is reduced.

D net force acting on the passenger is reduced, since the change in momentum is increased.

2.21 A car has an initial momentum of 5 000 kg·ms^{-1} east. The vector below shows the initial momentum of the car.



This car is involved in a collision and the change in momentum of the car is represented below.



The vector representing the final momentum of the car **after** the collision is …

A $p_f = 3\ 000\ kg{\cdot}ms^{-1}$ →

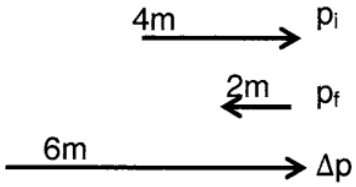
B $p_f = 3\ 000\ kg{\cdot}ms^{-1}$ ←

C $p_f = 8\ 000\ kg{\cdot}ms^{-1}$ →

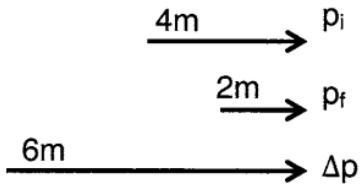
D $p_f = 8\ 000\ kg{\cdot}ms^{-1}$ ←

2.22 A ball of mass *m*, moving horizontally to the right, strikes a wall with a velocity of 4 ms^{-1}. The ball rebounds in the opposite direction with a velocity of 2 ms^{-1}. Which ONE of the options below correctly represents the momentum vectors of the initial momentum (p_i), the final momentum (p_f) and the change in momentum (Δp) of the ball in $kg{\cdot}ms^{-1}$?

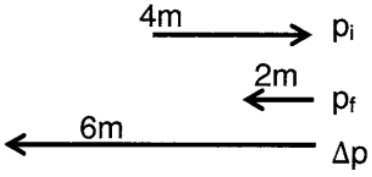
A



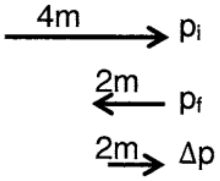
B



C



D



2.23 If the momentum of an object is doubled, then its kinetic energy is ...

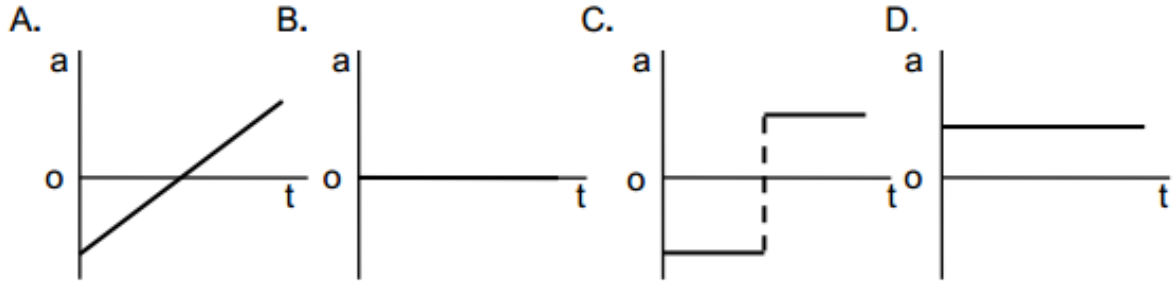
A halved.

B doubled.

C three times greater.

D four times greater.

2.24 An object has a momentum **p** for a time of **t** seconds. Which ONE of the following graphs correctly shows the acceleration-time relationship for this time interval?



2.25 A vehicle with mass *m* is moving horizontally at a constant velocity on a frictionless path. The kinetic energy of the vehicle is K and the momentum is p. The velocity of the vehicle can be given as:

A $\frac{K}{2p}$

B $\frac{2K}{p}$

C $\frac{K}{p}$

D $\frac{p}{K}$

QUESTION 3 (NEWTON'S LAWS)

3.1 A car of mass *m* collides head-on with a truck of mass 2*m*. If the car exerts a force of magnitude *F* on the truck during the collision, the magnitude of the force that the truck exerts on the car is …

A ½ *F*

B *F*

C 2*F*

D 4*F*

3.2 Net force is a measure of the …

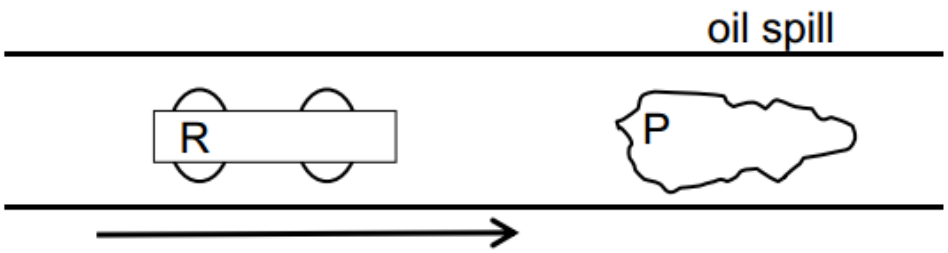
A change in energy.

B rate of change in energy.

C change in momentum.

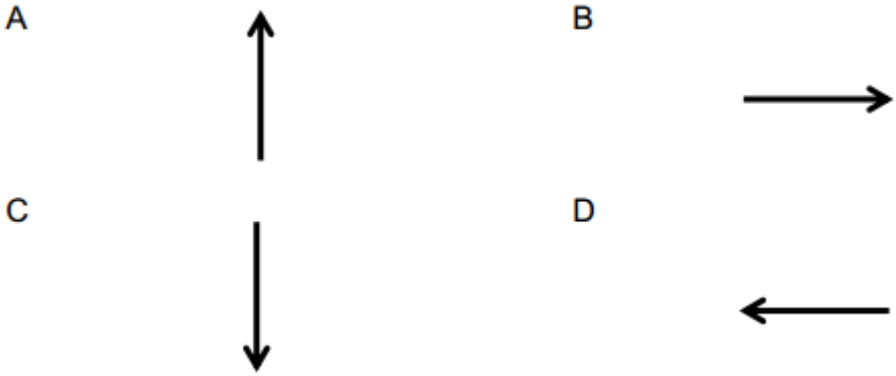
D rate of change in momentum

3.3 The following diagram shows a racing car R driving along a straight line to the right.

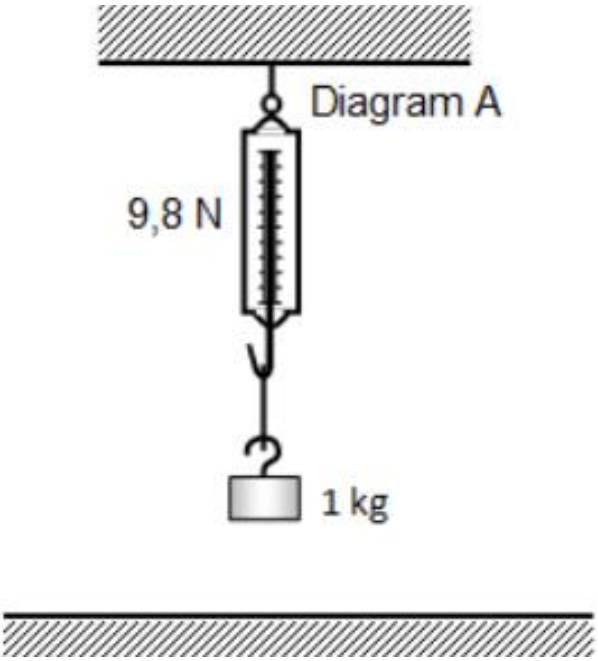


The driver of the racing car applies the brakes when the car reaches the oil spill at position P.

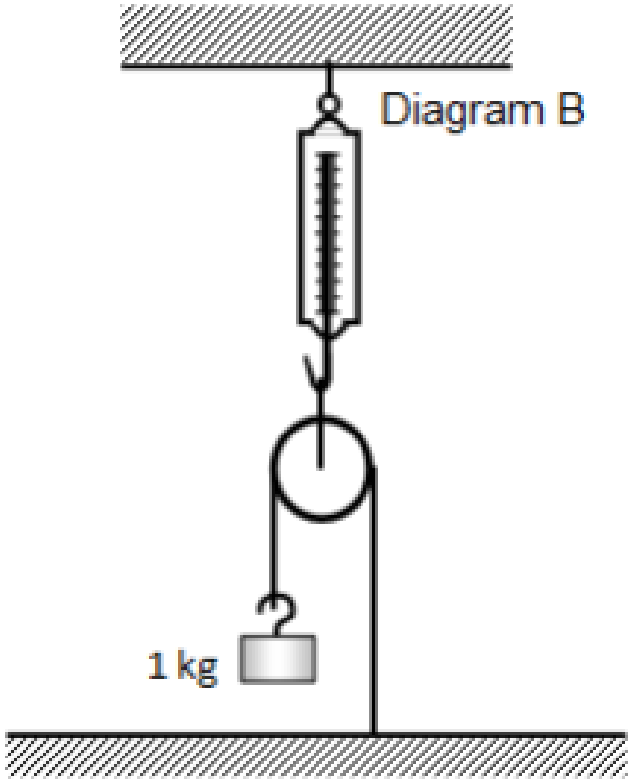
In which of the following directions will the racing car R slide?



3.4 Diagram A shows a 1 kg mass suspended by a Newton scale attached to the ceiling.



In diagram B, the same 1 kg mass is now suspended from a weightless, frictionless pulley by tying the rope to the floor.



If the reading on the scale in diagram A is 9,8 N, what will the scale read in diagram B?

A 4,9 N

B 9,8 N

C 14,7 N

D 19,6 N

3.5 John, who is standing in a lift, observes a 20N mass piece suspended from a spring balance fixed to the roof of the lift. He sees that the reading on the spring balance is less than 20N for a short time interval. During this short time interval the lift is …

A not moving.

B accelerating upwards.

C accelerating downwards.

D moving with constant velocity.

3.6 Which ONE of the following forces always acts perpendicular to the surface on which a body is placed?

A Normal force

B Frictional force

C Gravitational force

D Tension force

3.7 When a spaceship moves at constant velocity, it means that the resultant force acting on the body is zero. This phenomenon is best explained by

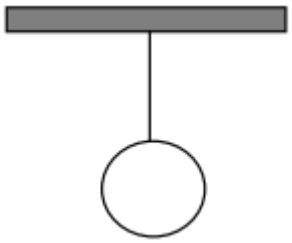
A Newton's First Law.

B Newton's Second Law.

C Newton's Third Law.

D Newton's Universal Gravitational Law.

3.8 A sphere is attached to a string, which is suspended from a fixed horizontal bar as shown in the sketch.



The reaction force to the gravitational force exerted by the earth on the sphere is …

A the force of the bar on the sphere.

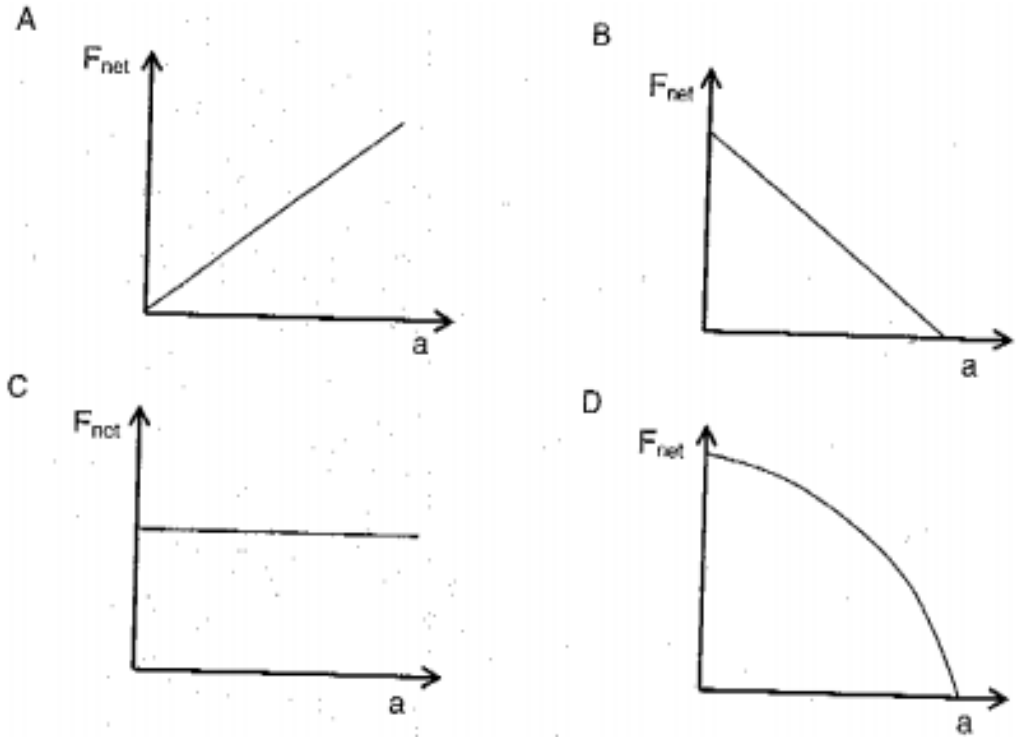
B the force of the string on the sphere.

C the force of the sphere on the earth.

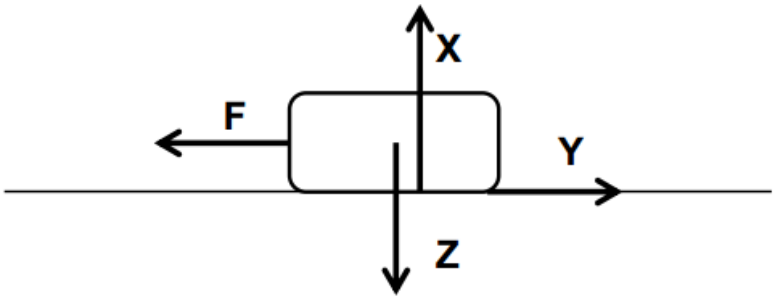
D the force of the bar on the string.

3.9 A 1 kg mass has a constant acceleration.

Which ONE of the following sketch graphs correctly shows the relationship between the net force, $\mathbf{F_{net}}$ and acceleration, a?



3.10 A learner pulls a block at a CONSTANT SPEED over a rough horizontal surface with a force **F**. The force diagram below shows all the forces acting on the block.



Which ONE of the following relationships between the magnitudes of the forces **F**, **X**, **Y** and **Z** is true?

A **F > Y** and **X = Z**

B **F > Y** and **X < Z**

C **F = Y** and **X = Z**

D **F = Y** and **X < Z**

3.11 The frictional force acting on a sliding object is …

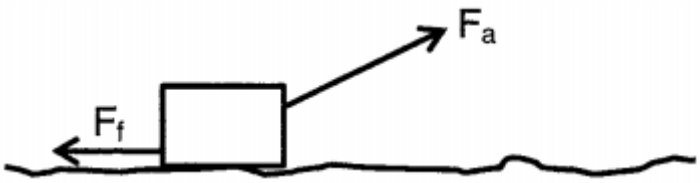
A dependent of the apparent area of contact.

B proportional to the normal force.

C dependent of the velocity of motion.

D independent of the type of surface

3.12 A constant force F_a acts on an object, causing it to move at a **constant speed** over a rough horizontal surface as sown in the diagram below.



How does the force of friction F_f compare to F_a?

A $F_f = F_a$

B $F_f > F_a$

C $F_f < F_a$

D $F_f = 0$

3.13 A net force **F** which acts on a body of mass *m* causes an acceleration *a*. If the same net force **F** is applied to a body of mass 2*m*, the acceleration of the body will be …

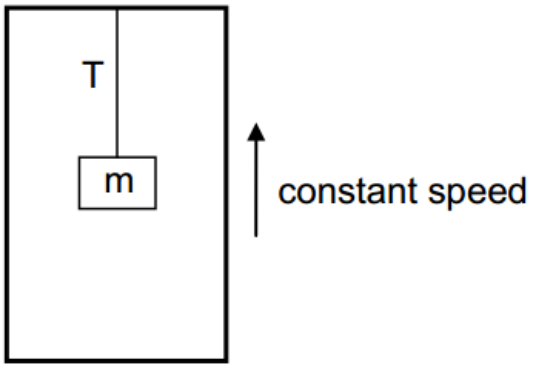
A ¼ a

B ½ a

C 2a

D 4a

3.14 An object, of mass m, hangs at the end of a string from the ceiling of a lift cage. The lift is moving upward at CONSTANT SPEED. The acceleration due to gravity is *g*.



Which ONE of the following statements regarding the tension (T) in the string is CORRECT?

The tension T …

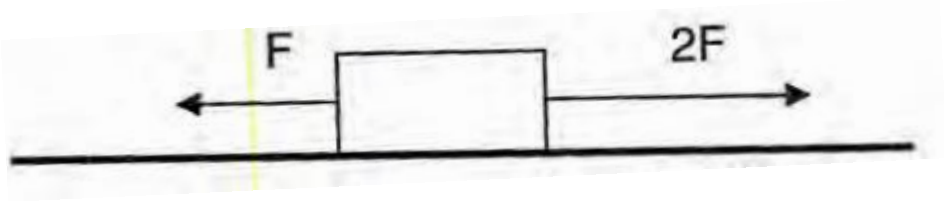
A will be equal to mg.

B will be less than mg.

C will be greater than mg.

D cannot be determined without knowing the speed of the lift cage.

3.15 A block is placed on a horizontal surface with negligible friction. Force **F** and **2F** are applied on the block as shown below.



Which ONE of the following correctly describes the motion of the block?

A The block moves at constant velocity to the right.

B The block moves with increasing acceleration to the right.

C The block moves at constant acceleration to the right.

D The block moves at constant acceleration to the left.

3.16 A block moves at velocity **v** across a horizontal surface **AB**. It the moves down slope **BC**. The coefficient of kinetic friction is the same along **ABC**.



Which ONE of the following statements about the frictional force experienced by the block if TRUE?

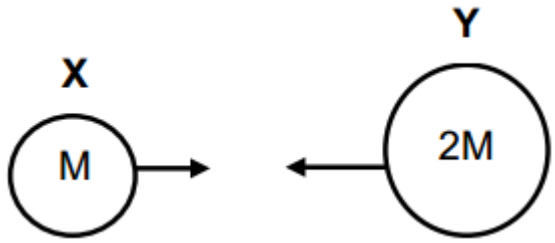
A $f_k(\text{slope}) > f_k(\text{horizontal})$

B $\mu_k N(\text{slope}) = \mu_k N(\text{horizontal})$

C $f_k(\text{slope}) < f_k(\text{horizontal})$

D $f_k(\text{slope}) = f_k(\text{horizontal})$

3.17 Two fairly large asteroids, **X** and **Y**, have masses M and 2M respectively. They move towards each.



If the magnitude of the acceleration of asteroid **X** is **a**, then magnitude of the acceleration of asteroid **Y** would be …

A ¼ **a**
B **a**
C ½ **a**
D 2 **a**

3.18 Two hypothetical planets, X and Y, have the same mass. The diameter of planet Y is twice that of planet X. If the acceleration due to gravity on the surface of planet X is g, then the acceleration due to gravity on the surface of planet Y will be …

A $\frac{g}{16}$

B $\frac{g}{4}$

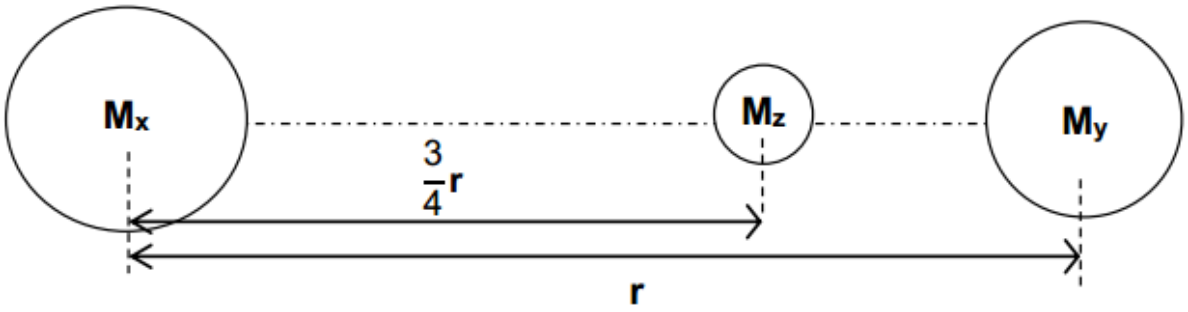
C $\frac{g}{2}$

D g

3.19 The magnitude of the gravitational force exerted by body A on body B, separated by a distance d, is F. What will the magnitude of the gravitational force be, if the distance between the two bodies increases to 4d?

A $\frac{1}{16}$ **F**
B $\frac{1}{4}$ **F**
C **F**
D 4 **F**

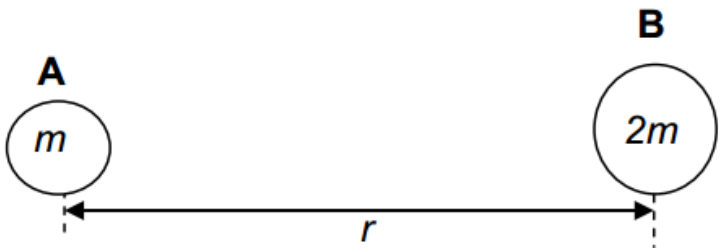
3.20 Two masses $\mathbf{M_x}$ and $\mathbf{M_y}$ are placed at a distance **r** apart. A third mass $\mathbf{M_z}$ experiences a ZERO resultant horizontal gravitational force when it is placed ¾ **r** from $\mathbf{M_x}$ on the line between $\mathbf{M_x}$ and $\mathbf{M_y}$.



The ratio of the two masses $\mathbf{M_x}$: **My** is:

A 3 : 1
B 4 : 3
C 9 : 1
D 16 : 1

3.21 Two isolated bodies, **A** and **B**, having masses *m* and 2*m* respectively, are placed a distance *r* apart.



Consider the following statements regarding the gravitational force exerted by the bodies on each other.

(i) The force exerted by B on body A is half that exerted by A on body B.
(ii) The force exerted on the bodies is independent of the masses of the bodies.
(iii) The force exerted on body A by B is equal but opposite to that exerted on body B by A.
(iv) The forces will always be attractive.

Which of the statements above is/are TRUE?

E (i), (ii) and (iv) only
F (ii), (iii) and (iv) only
G (iii) and (iv) only
H (iv) only

3.21 A spaceship experiences a weight of X on earth. It is sent into space and lands on a planet which has a mass twice that of the earth and a radius ½ that of the earth. The weight of the spaceship will be ...

A 8X
B ½ X

C X

D ¼ X

3.22 Two asteroids, 1 000 km apart, experience an attractive gravitational force **F** between each other**.** If the asteroids move away from each other until a distance of 2 000 km separates them, the magnitude of the new gravitational force will be…

A $\frac{1}{4}$ **F**

B $\frac{1}{2}$ **F**

C $\sqrt{\mathbf{F}}$

D 4 **F**

3.23 A satellite experiences a gravitational force of magnitude **F** on the surface of the earth. The radius of the earth is **R**. The satellite now circles the earth at an unknown height above the surface of the earth and experiences a gravitational force of magnitude ¼ **F**. This unknown height is ….

A **R**

B 2 **R**

C 3 **R**

D 4 **R**

3.24 Two objects, $\boldsymbol{m_1}$ and $\mathbf{m_2}$, a distance r apart, experience a gravitational force F. The mass of $\boldsymbol{m_1}$ is now **doubled** and the distance **r is halved**. The gravitational force between $\boldsymbol{m_1}$ and $\mathbf{m_2}$ will now be…

A $\frac{1}{8}$ F.

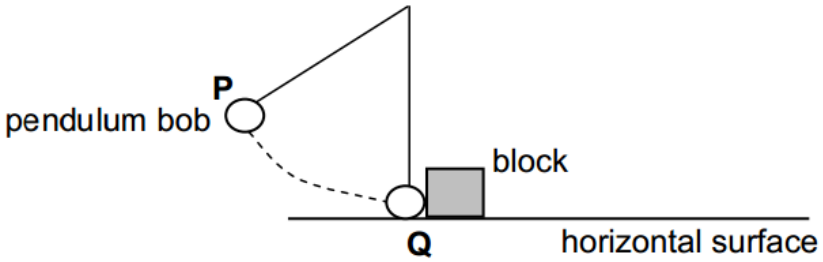
B $\frac{1}{2}$ F.

C F.

D 8 F.

QUESTION 4 (WORK, ENERGY & POWER)

4.1 A pendulum bob is released from point **P** above a horizontal surface. At the lowest point, **Q**, of its swing, it collides with a stationary block situated on a frictionless horizontal surface, as shown below. Ignore air friction.



Which ONE of the following combinations of **conservation laws** can be used to calculate the speed of the bob at **Q** immediately before and after colliding with the block?

	SPEED AT Q	SPEED AFTER COLLISION
A	Conservation of mechanical energy	Conservation of linear momentum
B	Conservation of linear momentum	Conservation of mechanical energy
C	Conservation of mechanical energy	Conservation of mechanical energy
D	Conservation of linear momentum	Conservation of linear momentum

4.2 A car is moving at a speed **v** and has kinetic energy **E**.
Which ONE of the following equations represents the magnitude of the momentum of the car?

A $\frac{\mathbf{E}}{2\mathbf{v}}$

B $\frac{\mathbf{E}\cdot\mathbf{v}}{2}$

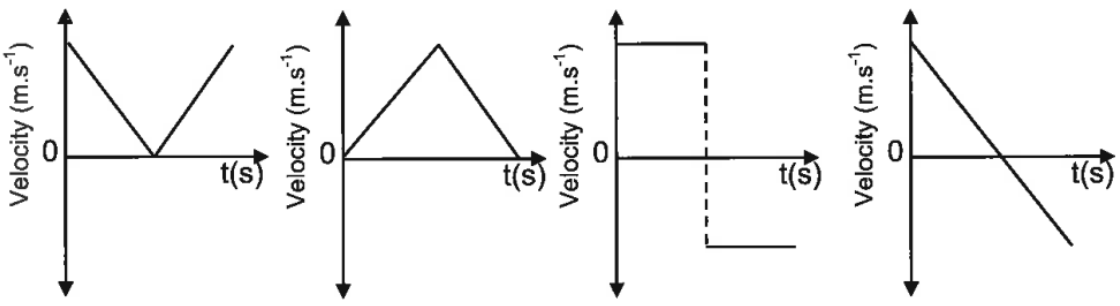
C $\frac{2\mathbf{v}}{\mathbf{E}}$

D $\frac{2\mathbf{E}}{\mathbf{v}}$

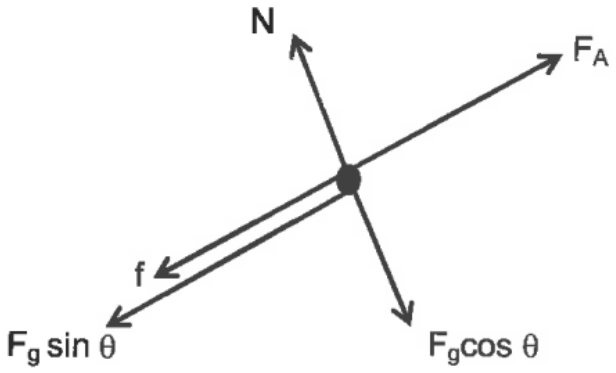
4.3 A ball is rolled up a smooth, incline plane. The ball stops briefly at some point on its way up and rolls back to the point where it was first released.

Which one of the following velocity-time graphs best shows the motion of the ball?

A B C D



4.4 The free-body diagram below shows all forces acting on an object that is moving up an inclined plane. All the forces are drawn to scale.



The **kinetic energy** of the object …

A increases.

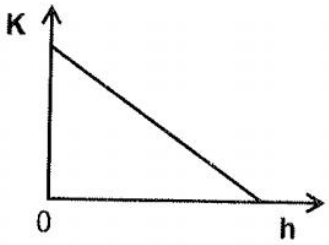
B decreases.

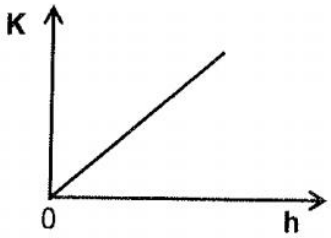
C is zero.

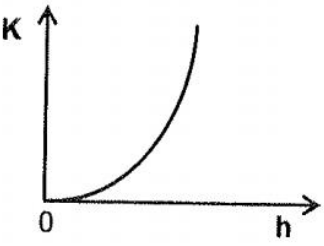
D remains the same.

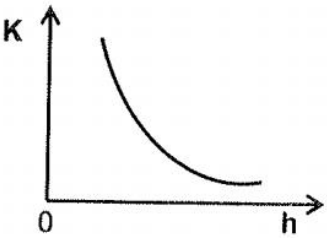
4.5 An object is dropped from a height, **h**, above ground level. Ignore the effects of air resistance.

Which ONE of the following graphs BEST represents the relationship between its kinetic energy **K** and its height **h** above ground level?

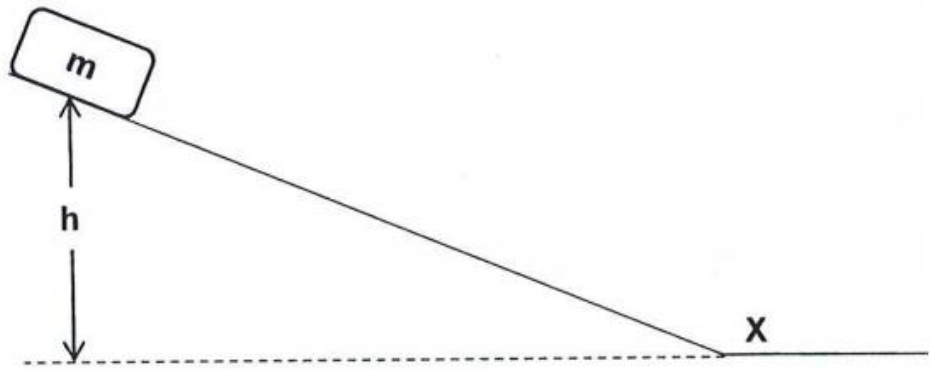
A


B


C


D


4.6 A block with a mass **m** moves from rest from a height **h** down a frictionless track and reaches point **X** with speed **v.**



Which ONE of the following changes will produce a speed of 2**v** at point **X**?

A Double the mass of the block.

B Double the gradient of the track from the same height **h**.

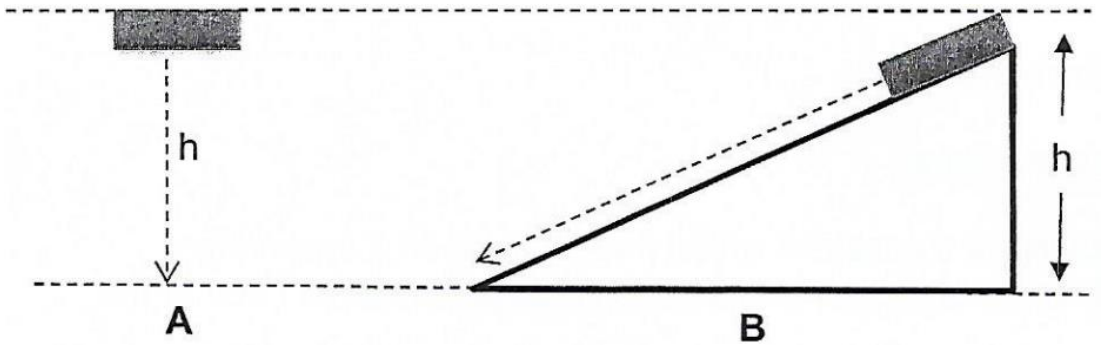
C Increasing the height to 4**h**.

D Using a track with a rough surface.

4.7 Consider the situations **A** and **B** below.

Situation **A:** A heavy block is dropped from a height *h.*

Situation **B:** The same block slides down a frictionless surface to the bottom, as shown in the diagram.



Which of the following statements about **A** and **B** is CORRECT?

A The magnitude of the gravitational force on the block is smaller in **A** than the gravitational force parallel to the surface on the block in **B**.

B The magnitude of the gravitational force on the block in **A** is equal to the gravitational force parallel to the surface on the block in **B**.

C The work done on the block by the gravitational force is the same in both cases.

D The work done on the block by the gravitational force in **B** is less than in **A**.

4.8 The speed of a bicycle increases from 2 $\mathrm{m \cdot s^{-1}}$ to 8 $\mathrm{m \cdot s^{-1}}$. Its kinetic energy increases by a factor of

A 4.

B 6.

C 8.

D 16.

4.9 The net work required to stop a moving object is equal to the …

A inertia of the object.

B change in kinetic energy of the object.

C change in momentum of the object.

D change in impulse of the object.

4.10 For a body fall from a GREAT height in the absence of air resistance, which ONE of the following statements regarding kinetic energy ($\mathrm{E_k}$) and gravitational potential energy ($\mathrm{E_p}$) is TRUE at ALL points of the motion?

A $E_p - E_k$ = constant

B $E_p + E_k$ = constant

C $\mathrm{E_k}$ is equal to $\mathrm{E_p}$

D E_k is less than E_p

4.11 The work done by a constant force F applied to an object to increase the object's speed from *v* to 2*v* is W.

The work done by the same force to increase the speed of the object from 0 to *v* will be…

A $\frac{1}{3}$ W

B $\frac{1}{2}$ W

C 2 W

D 3 W

4.12 When the net work done on an object is positive (greater than zero), the …

A kinetic energy of the object is zero.

B kinetic energy of the object is increasing.

C kinetic energy of the object is decreasing.

D kinetic energy of the object remains unchanged.

4.13 A ball is dropped from rest, in the absence of air friction, from a height **h** with mechanical energy equal to **E**. When the ball reached a height $\frac{1}{3}$**h**, the kinetic energy of the ball will be …

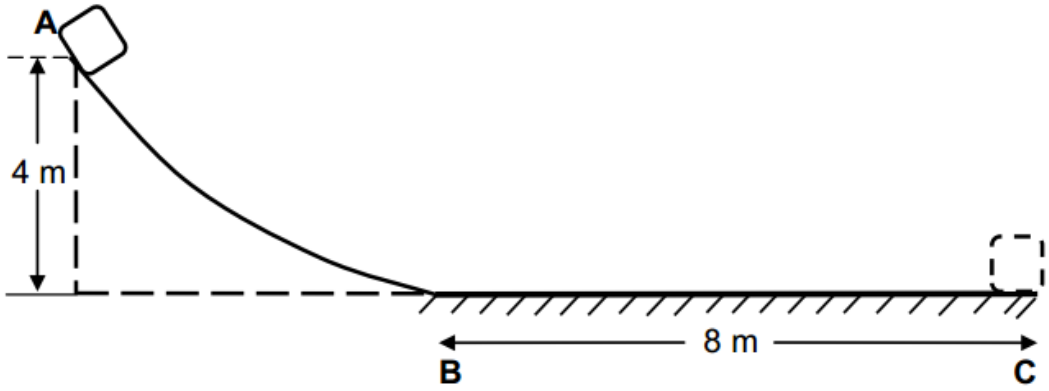
A $\frac{1}{3}$ **E**

B $\frac{2}{3}$ **E**

C **E**

D $\frac{3}{2}$ **E**

4.14 The diagram below shows a track, **ABC**. The curved section, **AB**, is frictionless. The rough horizontal section, **BC**, is 8 m long.



An object of mass 10 kg is released from point **A** which is 4 m above the ground. It slides down the track and comes to rest at point **C**.

Which ONE of the following statements about the mechanical energy of the 10 kg mass is INCORRECT?

A The mechanical energy increases from A to B.

B The mechanical energy decreases from B to C.

C The mechanical energy at B is equal to the kinetic energy at B.

D The mechanical energy is not conserved from B to C, but is conserved from A to B.

4.15 Which action stated below requires NO work to be done on that specific object?

A Lifting an object from the floor to the ceiling.

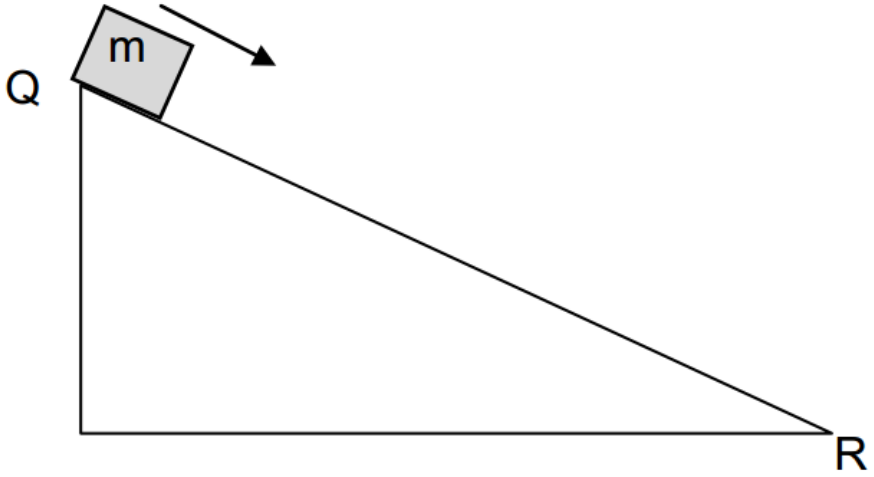
B Moving an object along the floor against friction.

C Decreasing the speed of an object until it comes to rest.

D Holding an object stationary above the ground.

4.16 A block of mass m is released from rest from the top of a frictionless inclined plane **QR**, as shown below.

The total mechanical energy of the block is $\mathrm{E_Q}$ at point **Q** and $\mathrm{E_R}$ at point **R**. The kinetic energy of the block at points **Q** and **R** is K_Q and $\mathrm{K_R}$ respectively.

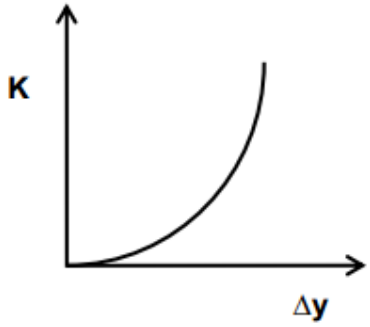


Which ONE of the statements regarding the total mechanical energy and the kinetic energy of the block at points **Q** and **R** respectively is CORRECT?

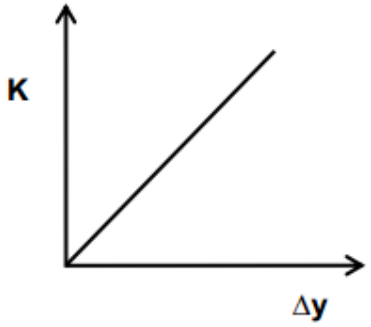
	TOTAL MECHANICAL ENERGY E	**KINETIC ENERGY K**
A	$\mathrm{E_Q} > \mathrm{E_R}$	$K_Q = \mathrm{K_R}$
B	$\mathrm{E_Q} = \mathrm{E_R}$	$K_Q < \mathrm{K_R}$
C	$\mathrm{E_Q} = \mathrm{E_R}$	$K_Q = \mathrm{K_R}$
D	$\mathrm{E_Q} < \mathrm{E_R}$	$K_Q > \mathrm{K_R}$

4.17 A stone falls freely from rest from the top of a building. Ignore air resistance. As the stone falls through the air, which **ONE** of the following graphs best represents the relationship between the kinetic energy (**K**) of the stone and its displacement (Δ**y**)?

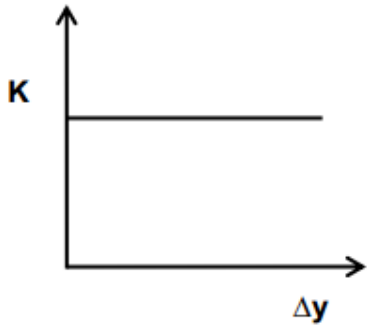
A



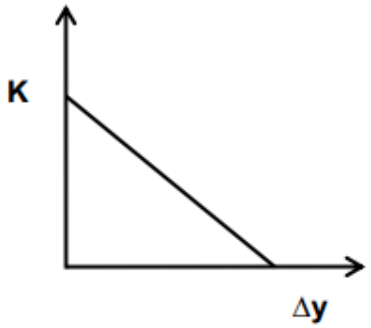
B



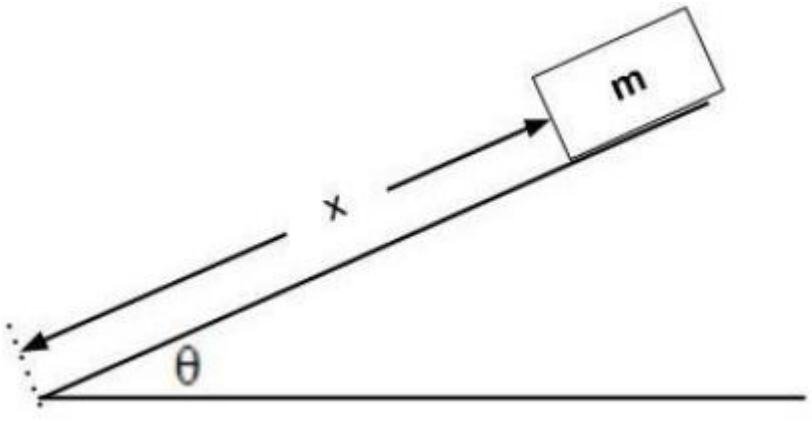
C



D



4.18 A block, with mass **m**, is sliding down a rough surface that makes an angle br>with the horizontal, through a distance **x** as indicated in the sketch below.
The net work done on the block will increase if...



A a greater frictional force acts on the block.

B the mass of the block is decreased.

C the distance **x** is decreased.

D the angle θ is increased.

4.19 A net force **F** accelerates two isolated objects, **P** and **Q**, from rest on a straight line for time **t** as shown below. Object **P** experiences an acceleration of **a** and object **Q** an acceleration of **2a**.



If the amount of work done by net force F on object P equals W, the amount of work done on Q will be …

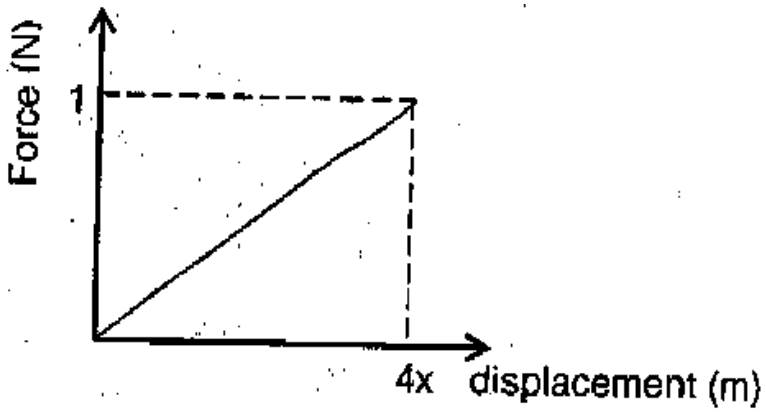
A W.

B ½ W.

C 2 W.

D 4 W.

4.20 The graph below shows the relationship between the applied force (F) on an object and the displacement (x) of the object in the direction of the applied force.



The average work done in Joules, done by the applied force for a displacement of 4x m is…

A ½ x

B 2x

C 3x

D 4x

4.21 A conservative force is a force …

A for which the work done in moving an object between two points is dependent of the path taken.

B for which the work done in moving an object between two points is not always constant.

C for which the work done in moving an object between two points is independent of the path taken.

D which is equal in magnitude, but opposite in direction to a non-conservative force.

4.22 Power can be defined as …

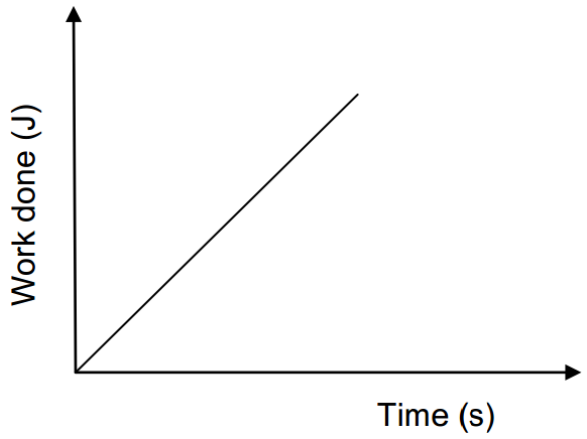
A the net force acting on an object.

B work done by friction.

C the total mechanical energy of an object.

D the rate at which work is done.

4.23 The graph below represents the relationship between the work done on an object and the time taken for this work to be done.



The gradient of the graph represents the …

A power.

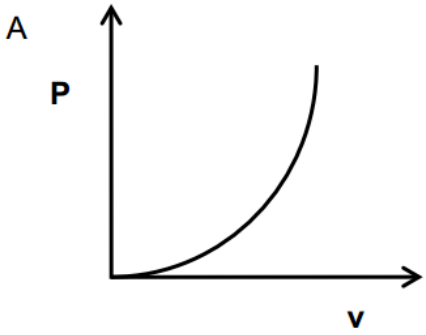
B momentum.

C kinetic energy.

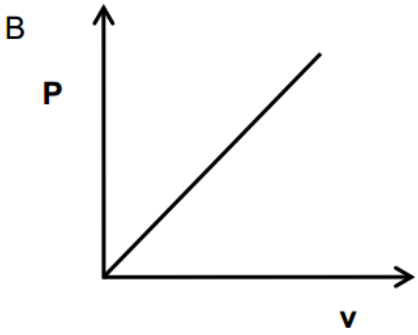
D potential energy.

4.24 A car travels along a straight level road with constant acceleration. Which **ONE** of the following power (**P**) versus velocity (**v**) graphs best represents the motion of the car?

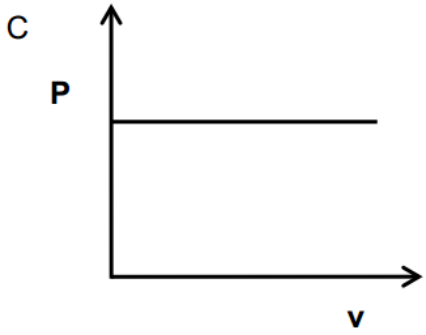
A



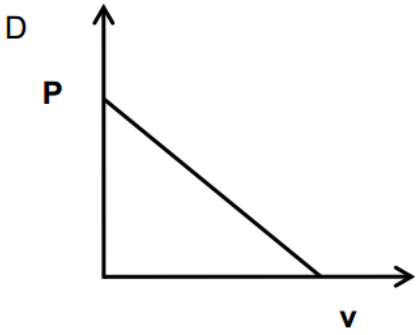
B



C



D



4.25 Which one of the following is NOT equivalent to the Watt?

A $J \cdot s^{-1}$

B $A \cdot V^{-1}$

C $A \cdot V$

D $A^2 \cdot \Omega$

QUESTION 5 (DOPPLER EFFECT)

5.1 Which ONE of the statements below about the Doppler Effect is CORRECT?

A The Doppler Effect is only applicable to sound waves.

B The Doppler Effect can be used to explain the expanding universe.

C Electrons are ejected from a metal surface by means of the Doppler Effect.

D A stationary listener hears a lower pitch of the sound from a siren of an approaching vehicle because of the Doppler Effect.

5.2 The Doppler Effect is the (apparent) change in the … of sound detected by a listener.

A frequency

B amplitude

C loudness

D softness

5.3 A source of sound with frequency of 620 Hz is places on a moving platform that approaches an educator at speed **v**. The educator hears sound with frequency $\mathbf{f_1}$.Then the source of sound is held stationary while the educator approached it at the same speed **v**. The educator now hears sound with a frequency $\mathbf{f_2}$.

A $\mathbf{f_1} = \mathbf{f_2} >$ 620 Hz

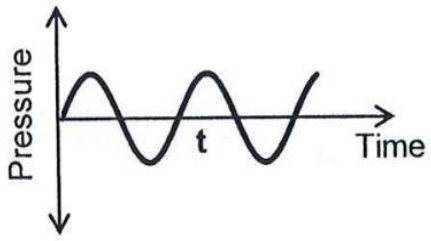
B $\mathbf{f_1} > \mathbf{f_2} >$ 620 Hz

C $\mathbf{f_1} = \mathbf{f_2} <$ 620 Hz

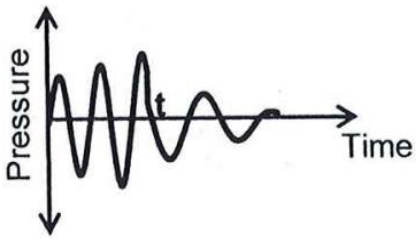
D $\mathbf{f_1} > \mathbf{f_2} >$ 620 Hz

5.4 During an experiment a car produces a sound with a constant frequency of 800 Hz. The car moves with a constant velocity past a stationary listener at time **t**. Which ONE of the following pressure-time graphs below CORRECTLY represents the sound of the car, as observed by the listerner?

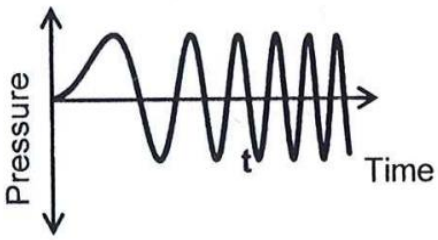
A



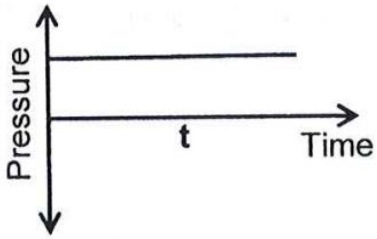
B



C



D



5.5 When the wavelength of sound detected by a stationary listeners decreases because the source is moving. It means the source is…

A rotating in a circular track on a fixed radius.

B moving away from a stationary listener.

C moving closer towards a stationary listener.

D stationary.

5.6 The hooter of a car emits sound of constant frequency as the car moves away from a stationary listener.

Which of the following properties of the sound heard by the listener will NOT change?

A Velocity

B Frequency

C Both wavelength and frequency

D Both frequency and loudness

5.7 An observer runs towards a stationary sound source. As the observer approaches the source, its pitch appears to increase because the …

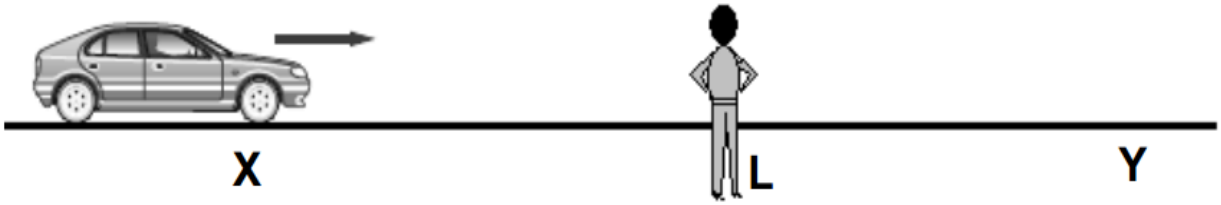
A loudness of the source appears to increase.

B frequency of the source appears to increase.

C frequency of the source appears to decrease.

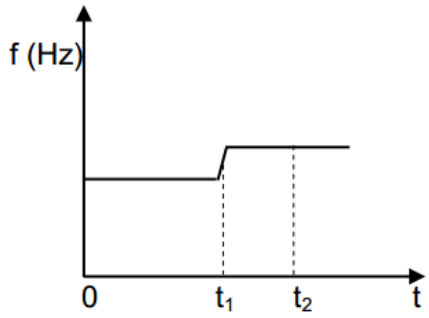
D wavelength of the source appears to increase.

5.8 A car sounds its horn whilst travelling at constant velocity along a straight road. At time t = 0 the car is at position **X** as shown below. At time t = t_1 the car moves past a stationary listener **L**. At time t = t_2 the car is at position **Y**.

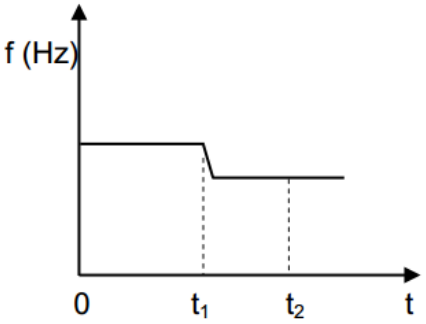


Which ONE of the following graphs best represents the variation of the frequency (pitch) of the horn with time as heard by the listener?

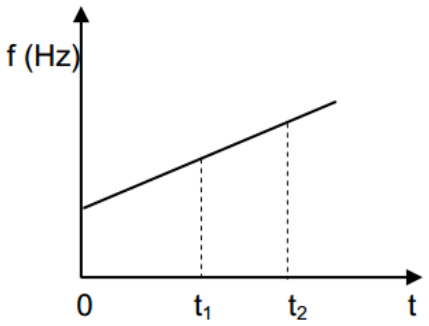
A



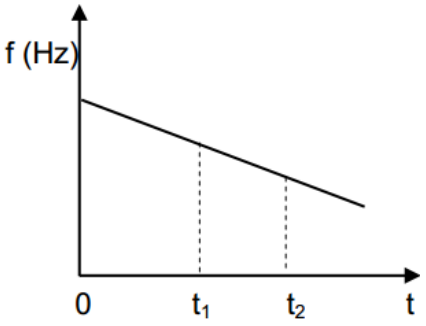
B



C



D



5.9 A stationary ambulance has its siren on. A girl moves away from the ambulance with a constant velocity $\mathbf{v_x}$. The ratio of the actual frequency of the siren of the ambulance to the apparent frequency as heard by the girl is 1,25.

The girl now stands still and the ambulance moves away from her with the same velocity $\mathbf{v_x}$. What will be the ratio of the actual frequency of the siren to the apparent frequency as heard by the girl?

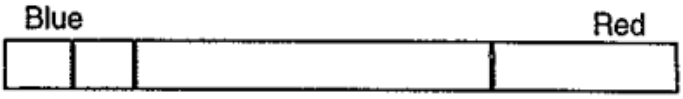
A 1,2
B 1,25
C 1,4
D 1,5

5.10 Astronomers obtained the following spectral line of an element:4

Spectrum of element in laboratory:



Spectrum of element from distant start:



This observation confirms that the…

A star is moving towards the earth.

B star is moving away from the earth.

C universe enlarges.

D star is undergoing no relative movement.

5.11 Which ONE of the following CANNOT be explained using the Doppler Effect?

A Emission of electrons from a metal surface

B 'Flow meters' used in hospitals

C Red spectral lines from distant stars being shifted

D Observed frequency of light from moving bodies being higher than expected

QUESTION 6 (ELECTROSTATICS)

6.1 Two identical small metal spheres on insulated stands carry equal charges and are a distance *d* apart. Each sphere experiences an electrostatic force of magnitude *F*. The spheres are now placed a distance ½ *d* apart. The magnitude of the electrostatic force each sphere now experiences is …

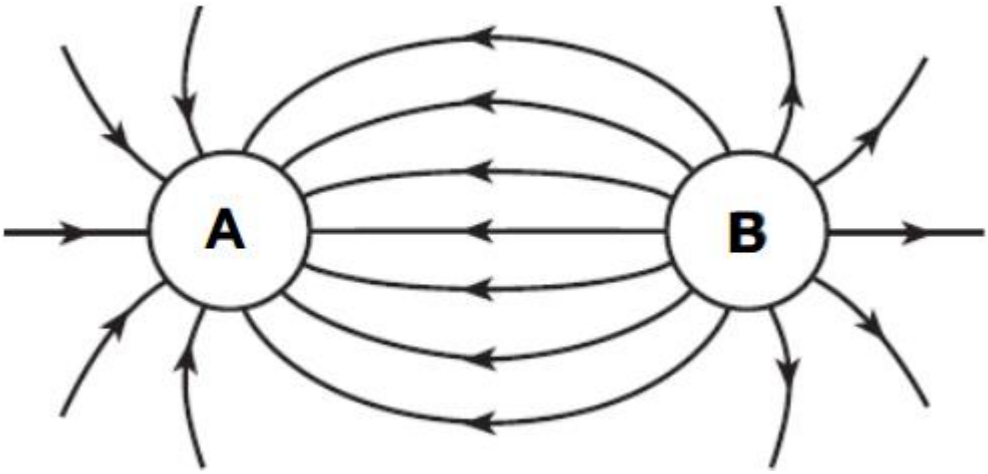
A ½ F

B F

C 2F

D 4F

6.2 The electric field pattern between two charged spheres, **A** and **B**, is shown below.



Which ONE of the following statements regarding the charge on spheres **A** and **B** is CORRECT?

A Spheres **A** and **B** are both positively charged.

B Spheres **A** and **B** are both negatively charged.

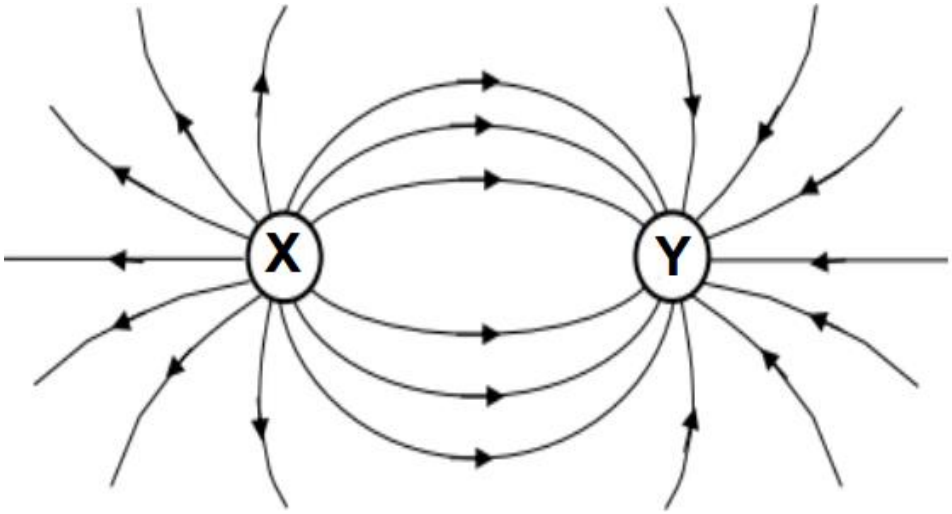
C Sphere **A** is positively charged and sphere **B** is negatively charged.

D Sphere **A** is negatively charged and sphere **B** is positively charged.

6.3 A positively charged metal sphere **X** on an insulated stand is brought into contact with an identical neutral metal sphere **Y** on an insulated stand. The two spheres are then separated. Which ONE of the following describes the charge on each sphere after they have been separated?

	Sphere X	**Sphere Y**
A	Positive	Neutral
B	Positive	Positive
C	Neutral	Positive
D	Neutral	Positive

6.4 The diagram below shows the electric field pattern due to two point charges **X** and **Y**.



Which ONE of the following represents the charge on **X** and **Y** respectively?

	Point Charge X	**Point Charge Y**
A	Negative	Negative
B	Positive	Positive
C	Positive	Negative
D	Negative	Positive

6.5 Two small identical metal spheres, each carrying equal charges *Q*, are brought into contact and then separated.

The charge on each sphere will now be …

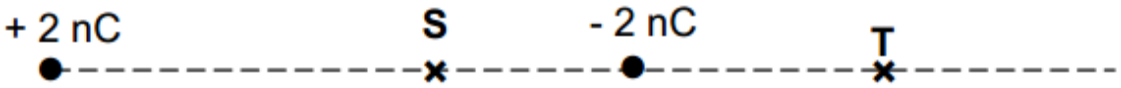
A zero.

B $\frac{Q}{2}$.

C Q.

D 2Q.

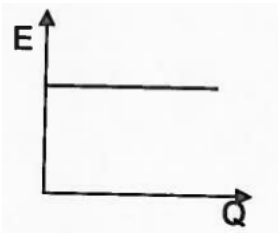
6.6 Two charges of +2 nC and -2 nC are located on a straight line. **S** and **T** are two points that lie on the same straight line as shown in the diagram below.

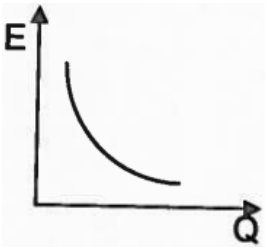


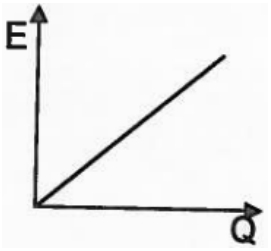
Which ONE of the following correctly represents the directions of the RESULTANT electric fields at **S** and at **T**?

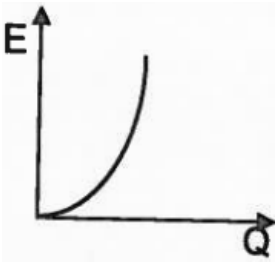
	DIRECTION OF THE RESULTANT ELECTRIC FIELD AT POINT S	**DIRECTION OF THE RESULTANT ELECTRIC FIELD AT POINT T**
A	Right	Left
B	Left	Left
C	Right	Right
D	Left	Right

6.7 Which one of the following graphs best represents the relationship between the magnitude of the electric field (E) and the charge (Q) at a distance ***r*** from the charge?

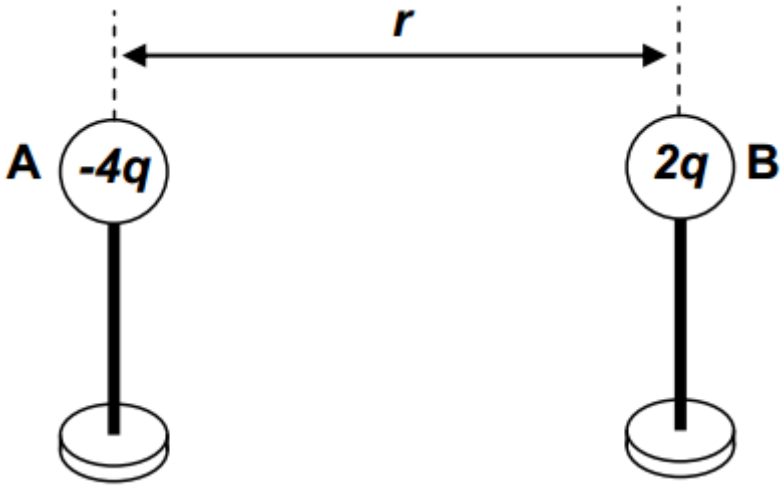
A 

B 

C 

D 

6.8 Two charged spheres, A and B, are placed on insulated stands a distance ***r*** apart, as shown below. The magnitude of the electrostatic force between them is ***F***.



The spheres are allowed to touch each other and are then moved back to their original positions. The magnitude of the electrostatic force in terms of ***F*** will now be …

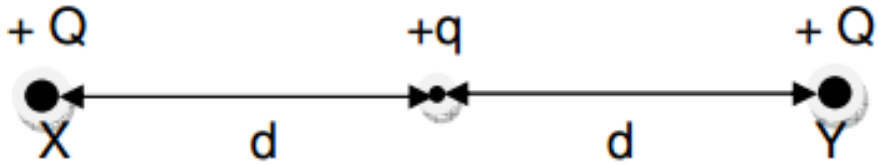
A 8 ***F***

B ***F***

C $\frac{1}{2}$ ***F***

D $\frac{1}{8}$ ***F***

6.9 A small test charge +q is placed exactly half way between two identical negatively charges, X and Y, each with a charge + Q, as shown below.



The test charge +q will

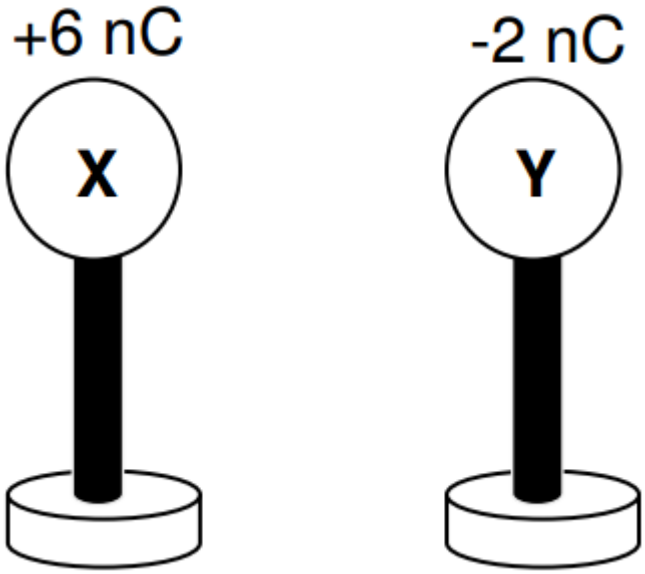
A remain where it is.

B move towards X.

C move towards Y.

D move vertically downwards .

6.10 Two identical metal spheres **X** and **Y**, on isolated stands, have charges of +6 nC and -2 nC respectively. **Y** is brought into contact with **X**. **Y** is then placed in its original position again.



The final charge on each sphere is:

	X	Y
A	0 nC	0 nC
B	3 nC	-1 nC
C	2 nC	2 nC
D	4 nC	4 nC

6.11 The centres of two identical metallic spheres, each carrying a charge Q, are a distance ***r*** apart. Which ONE of the following pairs of changes (that are made simultaneously) will double the electrostatic force that one charged sphere exerts on the other?

	Distance between centres of spheres	**Magnitude of charges**
A	decrease distance to $\frac{r}{2}$	double the charge on each sphere
B	decrease distance to $\frac{r}{2}$	reduce the charge on one sphere to $\frac{Q}{2}$
C	decrease distance to $\frac{r}{\sqrt{2}}$	reduce the charge on each sphere to $\frac{Q}{2}$
D	decrease distance to $\frac{r}{\sqrt{2}}$	double the charge on each sphere

6.12 The magnitude of an electric field, a distance *r* from a point charge is ***E***. The magnitude of an electric field, a distance 2*r* from the same point charge will be …

A $\frac{1}{4}$ ***E***

B $\frac{1}{2}$ ***E***

C 2***E***

D 4***E***

6.13 Two charged spheres of magnitudes 2Q and Q respectively are placed a distance r apart on insulating stands.

If the sphere of charge Q experiences a force **F** to the east, then the sphere of charge 2Q will experience a force …

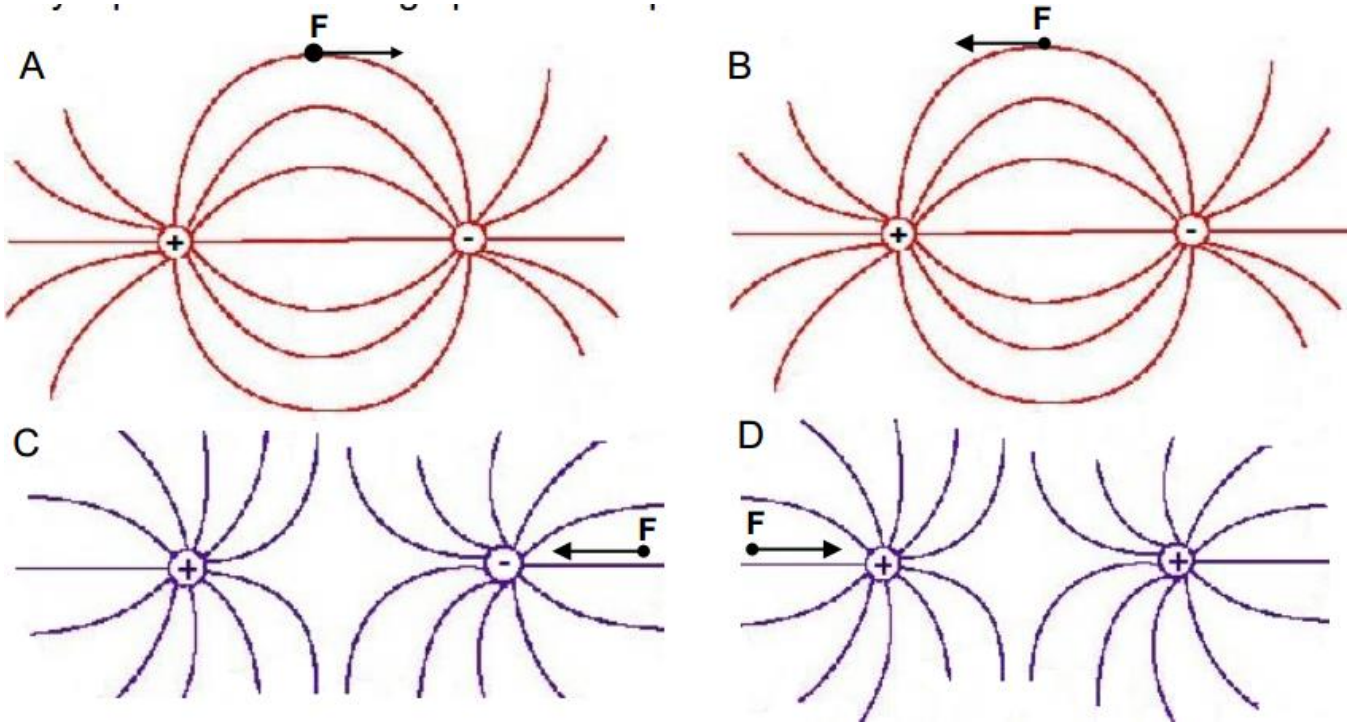
A **F** to the west.

B **F** to the east.

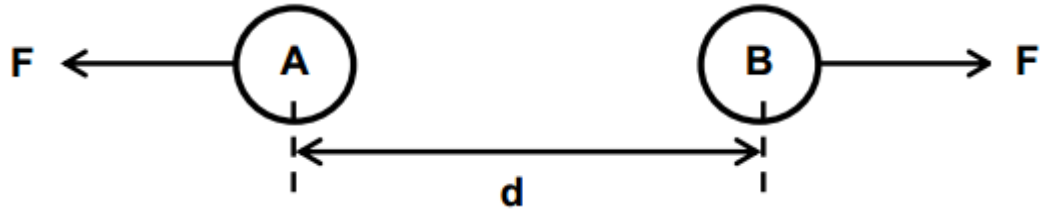
C 2**F** to the west.

D 2**F** to the east.

6.14 The electric field pattern of two small charged objects are shown below. Which one of the following diagrams correctly shows the force experienced by a positive test charge placed at a point in the field?



6.15 Three identical conducting spheres A, B and C are placed on insulated wooden stands. Spheres A and B carry equal charges. They are separated by a distance **d** and exert a force with magnitude **F** on each other, as shown in the sketch below.



The third sphere C, which is **uncharged,** touches A, then B, and is then removed. If the distance between the spheres remains the same, then the magnitude of the electrostatic force exerted on sphere B is now:

A $\frac{F}{2}$

B $\frac{F}{4}$

C $\frac{3F}{8}$

D $\frac{F}{16}$

6.16 An electric field….

A is a region in which a charged particle experiences an electric force.

B is the energy per unit charge experienced by a charged particle.

C is directly proportional to the product of current and resistance in a circuit.

D is the rate of work done by an electrical appliance.

6.17 Two spheres, A and B, have charges of +1 C and +2 C respectively. They are brought into contact with each other and then moved to their original positions.

The amount of charge transferred is …

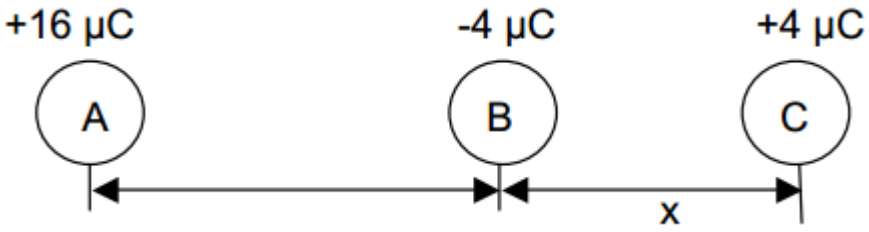
A 0,5 C from B to A.

B 0,5 C from A to B.

C 1,5 C from B to A.

D 1,5 C from A to B.

6.18 Three small identical spheres, **A, B** and **C** is charged as shown in the diagram. The distance between sphere **B** and **C** is x.



For sphere **B** to experience no resultant electrostatic force, the distance between **A** and **B** must be …

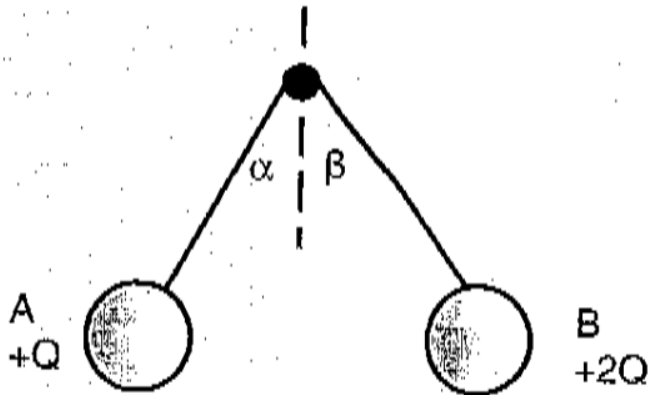
A ¼ x.

B ½ x.

C 2 x.

D 4 x.

6.19 Sphere A, with a charge of +Q, and sphere B, with a charge of +2Q, are suspended from the same insulated point as shown in the diagram below. (the diagram is not drawn to scale.)



The spheres are allowed to move freely until they come to rest on their own.
How will the values of the angles α and β compare to each other once the spheres come to rest?

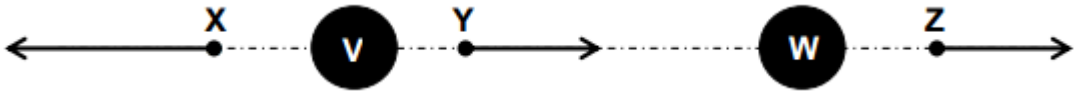
A $\alpha = \beta$

B $\alpha < \beta$

C $\alpha > \beta$

D $\alpha = \beta = 0$

6.20 Two charged spheres **V** and **W** are located on a straight line. **X, Y** and **Z** are three points on the same straight line. The positions of points X, Y and Z are as indicated and the direction of the NET electric field at points **X, Y** and **Z** is shown in the diagram below.

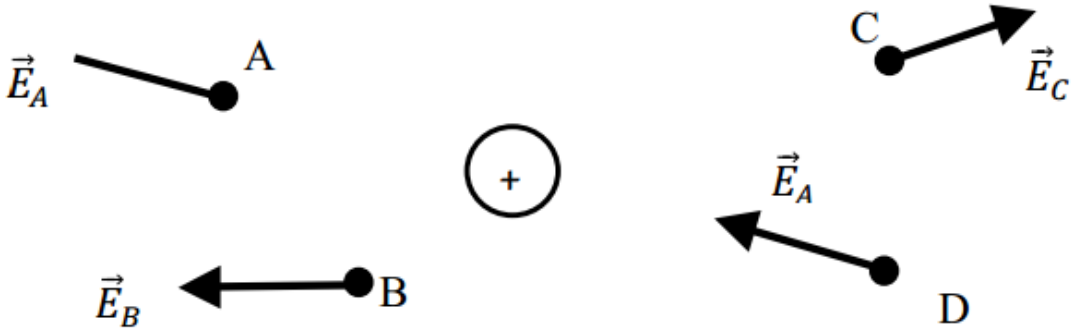


Which ONE of the following combinations represent the charges on each of the spheres **V** and **W**?

	Charge of V	**Charge of W**
A	Positive	Positive
B	Neutral	Positive
C	Negative	Negative
D	Positive	Negative

6.21 A learner has represented the electric field $\boldsymbol{E}$ at points A, B, C and D due to a positive point charge Q as shown below.

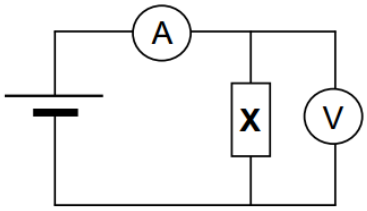
Which ONE is the correct representation?



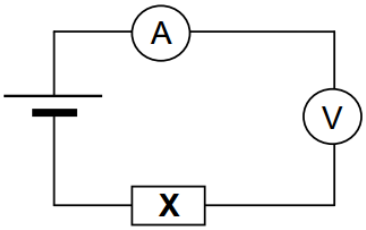
QUESTION 7 (ELECTRIC CIRCUITS)

7.1 Which ONE of the circuits below can be used to measure the current in a conductor **X** and the potential difference across its ends?

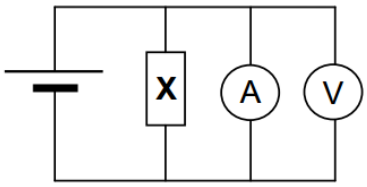
A



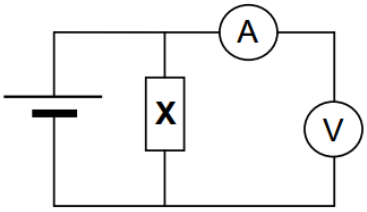
B



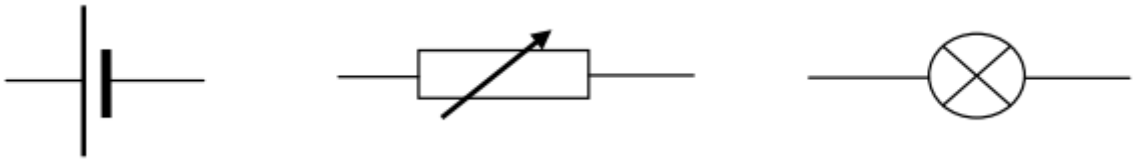
C



D



7.2 Consider the three circuit components represented below.



Which ONE of the options below best represents the names of the components in the correct sequence, from left to right?

A Light bulb, resistor, cell

B Resistor, light bulb, cell

C Cell, light bulb, variable resistor

D Cell, variable resistor, light bulb

7.3 Which statement below is CORRECT for resistors connected in parallel in a circuit?

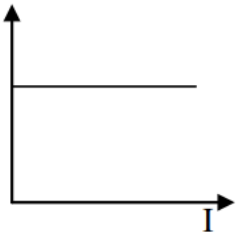
A The voltage (V) across the combination is divided but the resistors each have the same current (I).

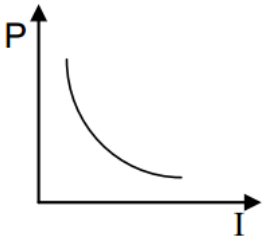
B The current (I) across the combination is divided but the resistors each have the same voltage (V).

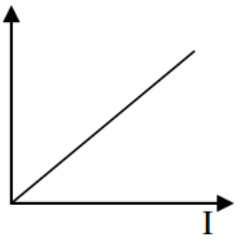
C The current (I) and the voltage (V) across the combination is divided.

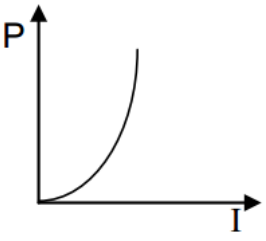
D The current (I) and the voltage (V) across the combination is the same across each resistor.

7.4 Which ONE of the following graphs best represents the relationship between the electrical power and the current in a given ohmic conductor?

A 

B 

C 

D 

7.5 Two resistors of equal resistance are connected in SERIES to a battery with negligible internal resistance. The current through the battery is *I*.

When the two resistors are connected in PARALLEL to the same battery, the current through the battery will be …

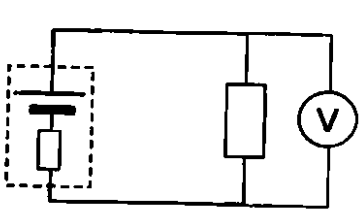
A *½ I.*

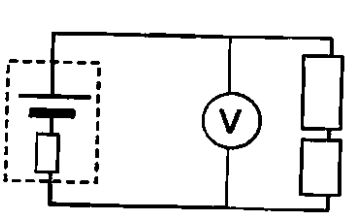
B *I.*

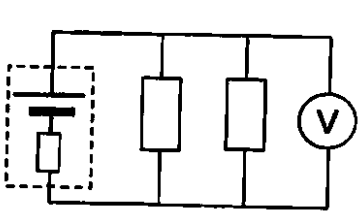
C *2I.*

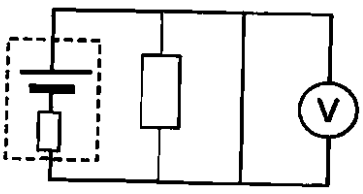
D *4I*

7.6 In which ONE of the circuits will the reading on the voltmeter be the smallest? (The cells and the resistors are **identical** in each circuit.)

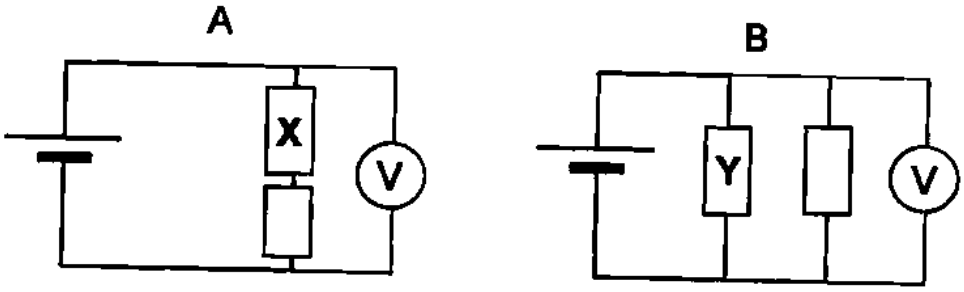
A 

B 

C 

D 

7.7 In circuit **A** and **B** shown below all resistors and cells are **identical**.



If the power dissipated by **X** equals **P**, then the power dissipated by **Y** will be…

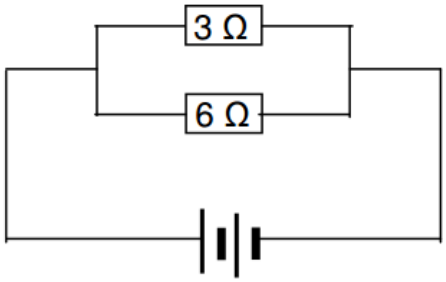
A ¼ **P**

B **P**

C **2P**

D **4P**

7.8 In the circuit diagram below, the power dissipated by the 3 Ω resistor is **P**. The power dissipated by the 6 Ω resistor is…



A ¼ **P**

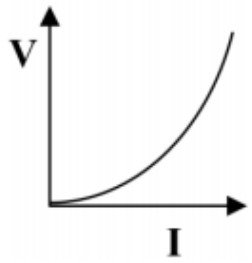
B **½ P**

C **2P**

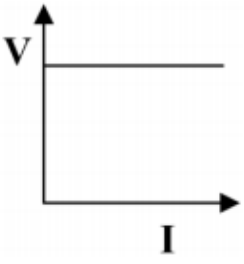
D **4P**

7.9 Which one of the following graphs best represents the relationship between the potential difference (V) across an ohmic conductor and the current (I) in the conductor at constant temperature?

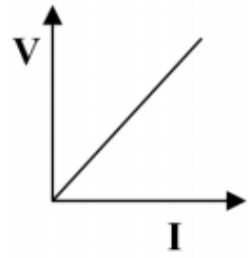
A



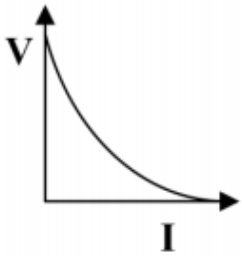
B



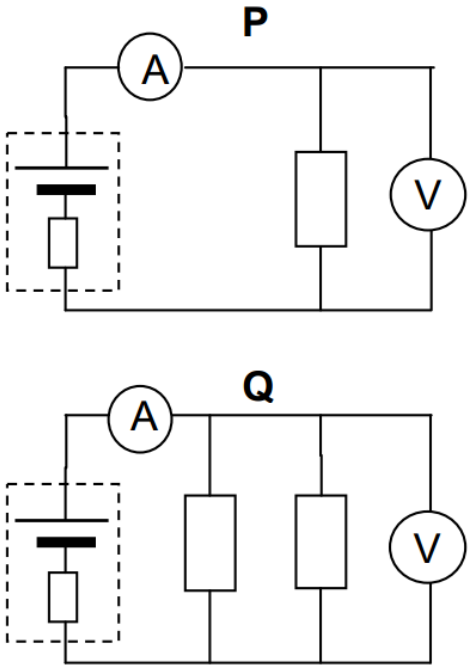
C



D



7.10 In the circuits shown below all resistors and cells are identical.

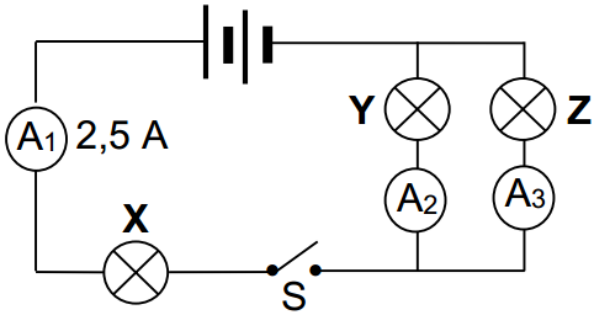


Which ONE of the following gives the correct comparison between the voltmeter and ammeter readings in circuit **P** and **Q**.

	VOLTMETER READING	AMMETER READING
A	$V_P > V_Q$	$A_P > A_Q$
B	$V_P > V_Q$	$A_P < A_Q$
C	$V_P < V_Q$	$A_P = A_Q$
D	$V_P = V_Q$	$A_P < A_Q$

7.11 Three identical light bulbs **X**, **Y** and **Z** are connected in a circuit diagram as shown below. The internal resistance of the battery is negligible.

When switch S is closed, the reading on the ammeter A1 is 2,5 A.

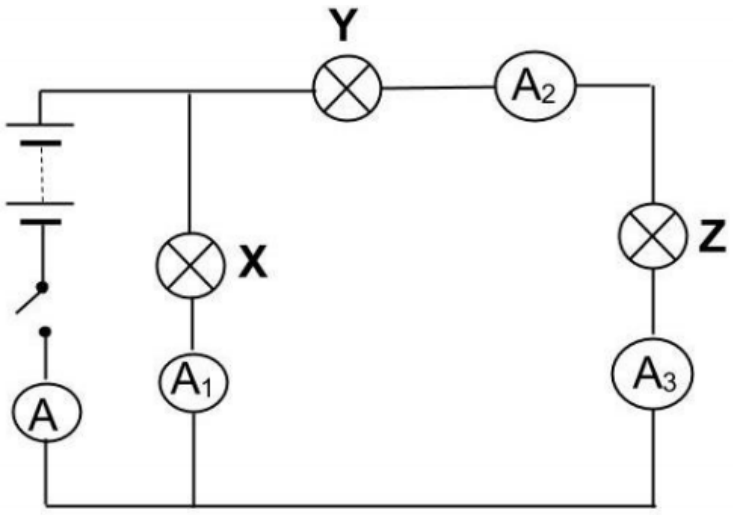


Which ONE of the following options correctly describes the readings on the ammeters (in ampère) if light bulb **Z** burns out?

	A_1	A_2	A_3
A	3.2	3.2	0
B	2.5	1.25	0
C	1.8	1.8	0
D	1.2	1.1	0.1

7.12 Three light bulbs, **X**, **Y** and **Z**, are connected in a circuit as shown below. **X** and **Y** are identical and both has a resistance **R**, while the resistance of **Z** is **2R**. The battery has negligible internal resistance.

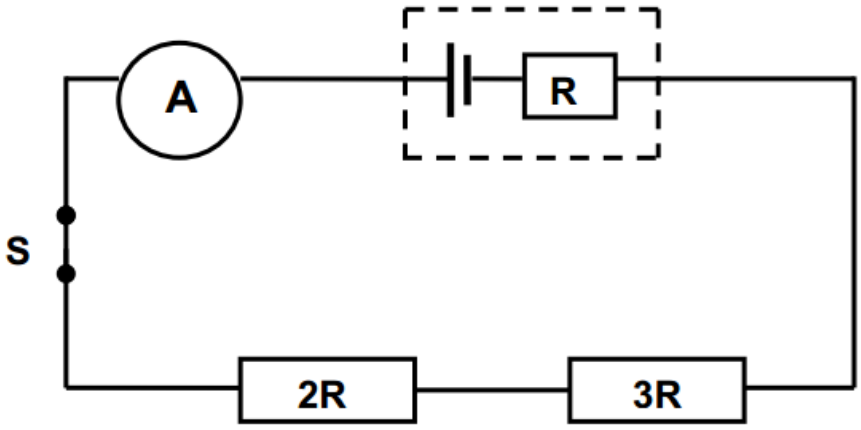
When switch **S** is closed, all the bulbs glow. The reading on ammeter **A** is 2,0 A.



Which ONE of the following correctly describes the readings on the ammeters (in amperes) when bulb **Z** burns out?

	A_1	A_2	A_3	A
A	2	0	0	2
B	1.5	0	0	1.5
C	0.5	0.5	0	1
D	0.2	0.2	0.2	0.6

7.13 In the circuit below, two resistors of resistance 2R and 3R are connected in series with a battery, which has an emf of E and an internal resistance R.



What is the potential difference across the resistor of resistance 2R?

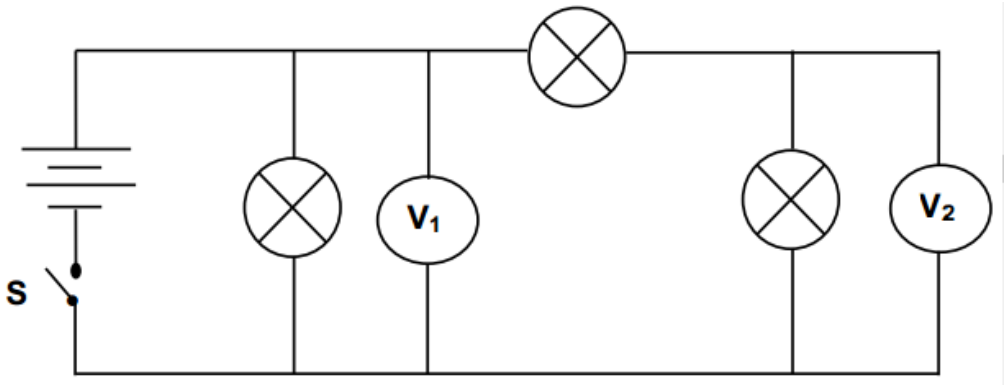
A $\frac{E}{3}$

B $\frac{2E}{5}$

C $\frac{E}{2}$

D $\frac{E}{6}$

7.14 Three identical light bulbs are connected in a circuit as shown below. The resistances of the battery and connecting wires can be ignored.



Which ONE of the following statements is CORRECT when switch **S** is closed?

The reading on $\mathbf{V_1}$ is…

A half that on $\mathbf{V_2}$.

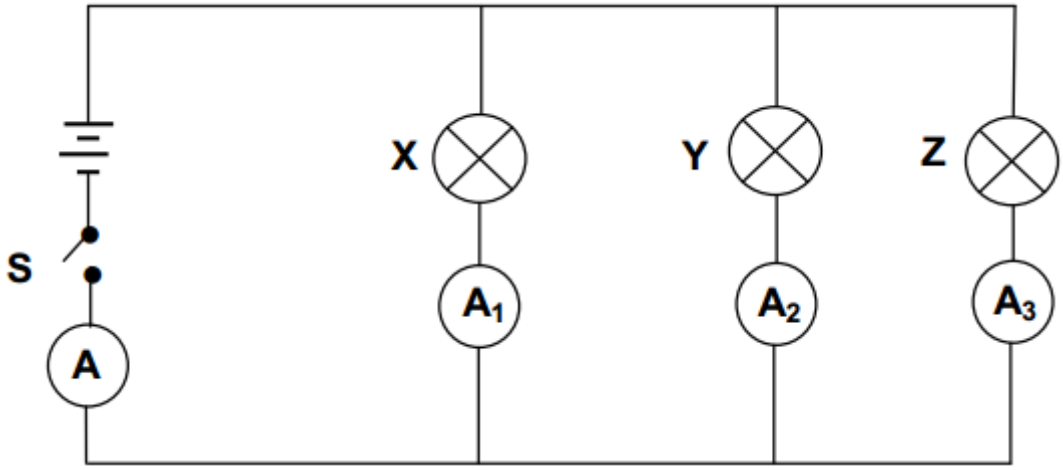
B equal to that on $\mathbf{V_2}$.

C twice that on $\mathbf{V_2}$.

D three times that on $\mathbf{V_2}$.

7.15 Three light bulbs, **X**, **Y** and **Z** with resistances *R*, 2*R* and *R* respectively, are connected in a circuit as shown below. The battery has negligible internal resistance.

When switch **S is closed**, all the bulbs light up. The reading on ammeter **A** is 2,5 A.

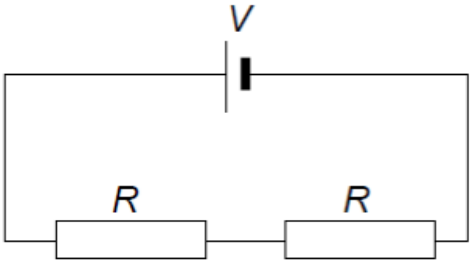


Which ONE of the following correctly describes the readings on the ammeters (in amperes) when bulb **Z** burns out?

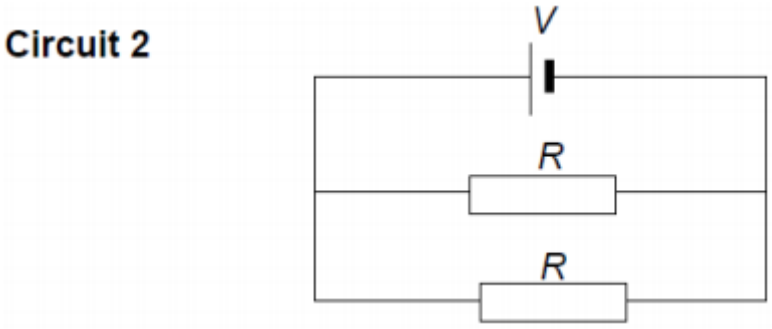
	A_1	A_2	A_3	A
A	1.25	1.25	0	2.5
B	1.6	0.8	0.1	2.5
C	0.75	0.75	0	1.5
D	1	0.5	0	1.5

7.16 The two resistors in circuit 1 below are identical. They are connected in series to a cell of emf *V* and negligible internal resistance. The power dissipated by each resistor is *P*.

Circuit 1



The two resistors are now connected in parallel, as shown in circuit 2 below.



The power dissipated by each resistor in the circuit 2 is …

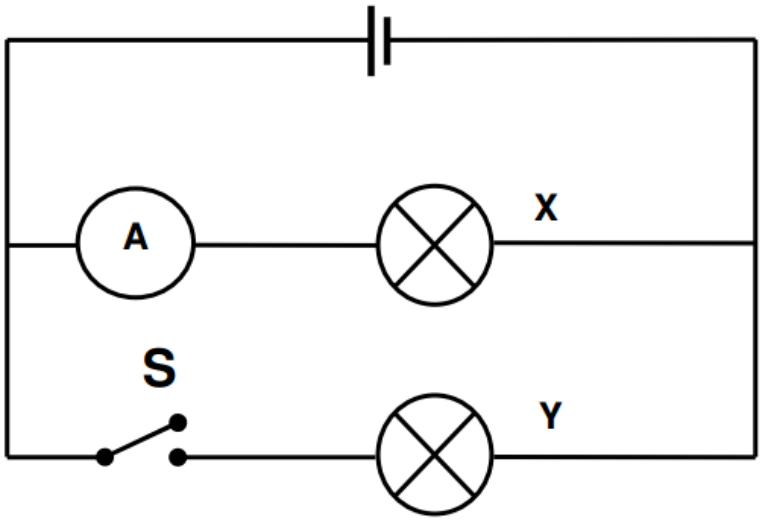
A 2P

B 4P

C 8P

D 16P

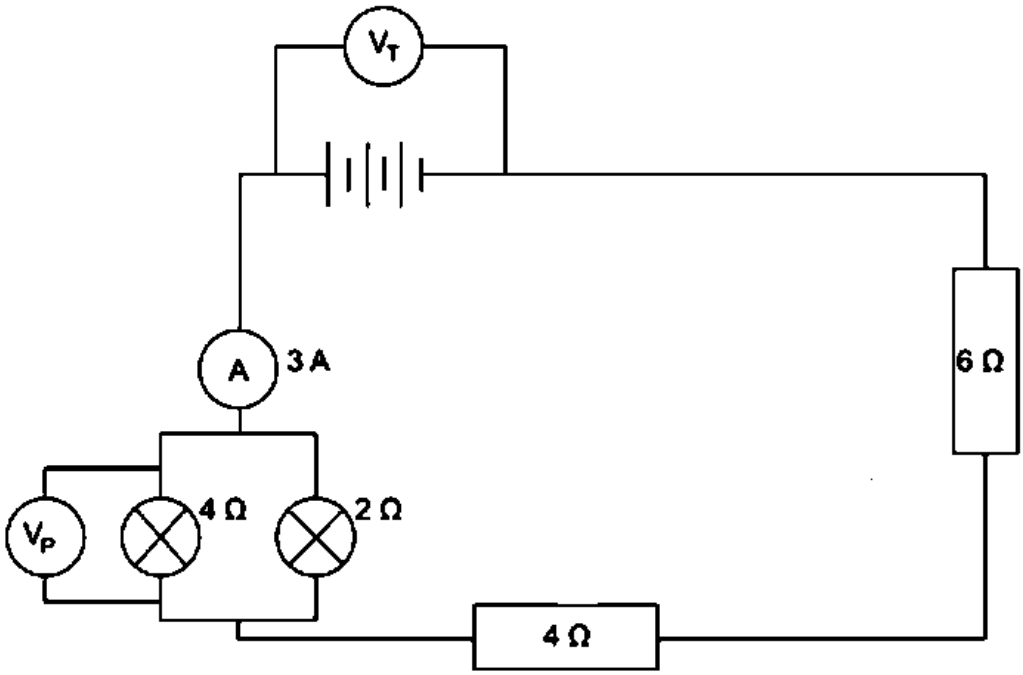
7.17 In the circuit shown below, bulbs X and Y are identical.



Which **ONE** of the following correctly describes the initial change in total resistance and the reading on the ammeter when switch S is closed?

	R (Total Resistance)	**I (Ammeter Reading)**
A	Decreases	Unchanged
B	Increases	Unchanged
C	Increases	Decreases
D	Decreases	Increases

7.18 The circuit diagram shows two light bulbs of resistance 4 Ω and 2 Ω each connected in parallel to the circuit. The two resistors of resistance 4 Ω and 6 Ω each are connected in series to the circuit.



If the 2 Ω light bulb burns out, what happens to the reading on V_P?

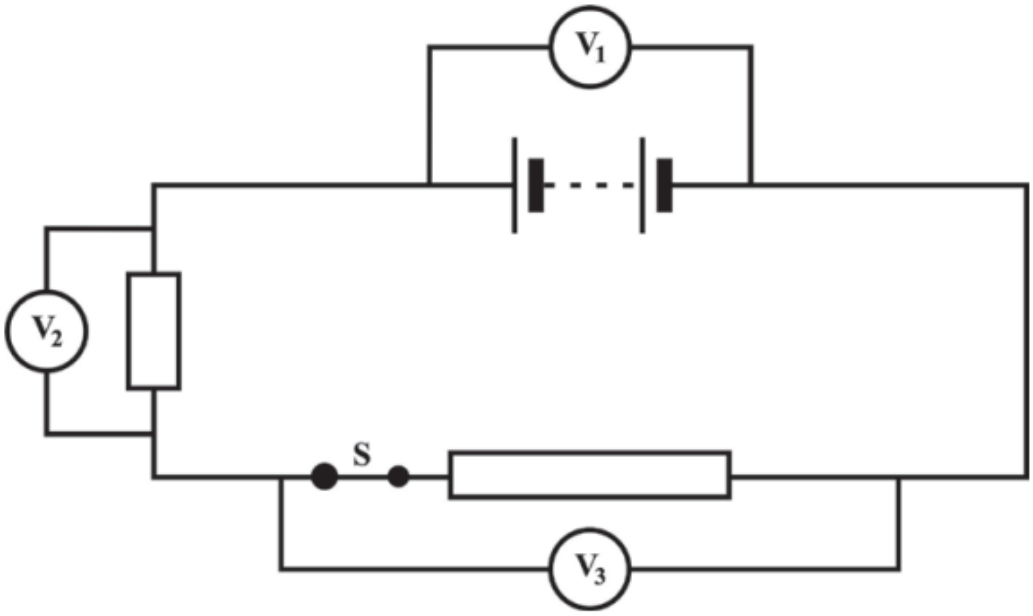
A Stays the same

B Decreases

C Increases

D Becomes zero.

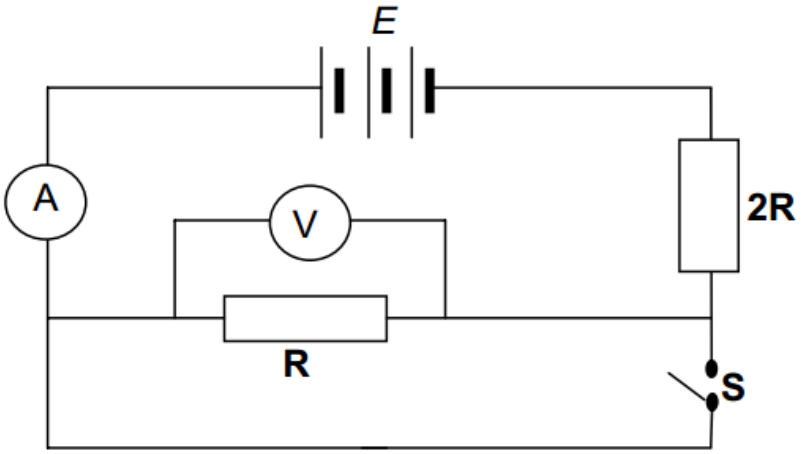
7.19 In the circuit shown below the resistance of the switch and connecting wires is negligible. The voltmeters have very high resistance. The battery has significant internal resistance.



How are the readings on the voltmeters V_1 and V_2 affected when switch S is opened?

	V_1	V_2
A	No change	Increase
B	No change	Decrease
C	Increase	Decrease
D	Increase	Increase

7.20 In the circuit diagram below, the internal resistance of the battery and the resistance of the conducting wires are negligible. The emf of the battery is *E*.



When switch **S** is closed, the reading on voltmeter V, in volts, is ...

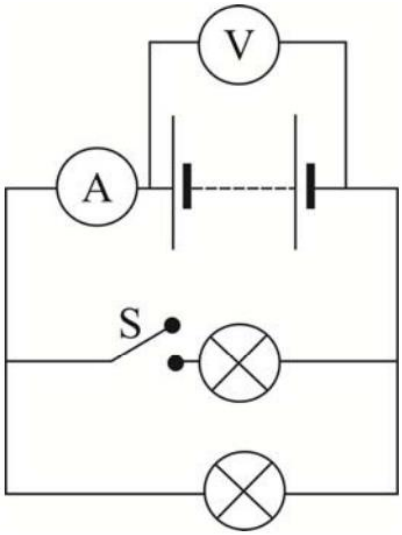
A 0

B $\frac{1}{3}E$

C $\frac{2}{3}E$

D E

7.21 In the circuit shown below the resistance of the ammeter, switch and connecting wires is negligible. The voltmeter has a very high resistance. The battery has **significant** internal resistance.



How are the readings on the ammeter and voltmeter affected if switch **S** is closed?

	AMMETER	**VOLTMETER**
A	Decrease	Increase
B	Decrease	No change
C	Increase	No change
D	Increase	Decrease

QUESTION 8 (ELECTRODYNAMICS)

8.1 The device that uses electrical energy to produce mechanical energy is called.

A Dynamo

B Alternator

C Electric motor

D Generator

8.2 The diagram below shows a coil in a magnetic field.

When the coil is part of a DC motor, which ONE of the following must be connected to **P** and **Q**?

A AC Supply

B Slip rings

C Split ring

D Soft iron core

8.3 Which ONE of the following combinations represents the component(s) present AS WELL AS the energy conversion in a direct current (DC) motor?

	Component	Energy Transfer
A	Split ring commutator	Electrical to mechanical energy
B	Slip rings	Mechanical to electrical energy
C	Slip rings	Electrical to mechanical energy
D	Split ring commutator	Mechanical to electrical energy

8.4 In a AC generator the current to the external circuit is delivered through the …

A coils.

B battery.

C slip rings.

D split rings (commutators).

8.5 An experiment was carried out to study the effect of a magnetic field on a current carrying conductor **Y**, placed within a magnetic field. **X** and **Z** are poles of magnets.



When a current flows through **Y**, the conductor moves downwards as shown by the arrow. Which one of the following combinations, regarding the **polarities** of the magnets and **direction of the current** is correct?

	Polarity X	Polarity Z	Current direction in Y
A	South	North	Out of the page
B	North	North	Into the page
C	North	South	Out of the page
D	North	South	Into the page

8.6 A model car has a motor with variable speed. Which ONE of the following modifications for the motor will not increase the speed of rotation of the motor?

A Increasing the number of turns in the coil of the motor.

B Winding the armature coil around a zinc core.

C Increasing the current flowing through the coil of the motor.

D Increasing the strength of the magnet in the motor.

8.7 A lamp connected to an AC supply lights up with the same brightness as it does when connected to an **X** volt DC source. The power dissipated by the lamp, is equal to …

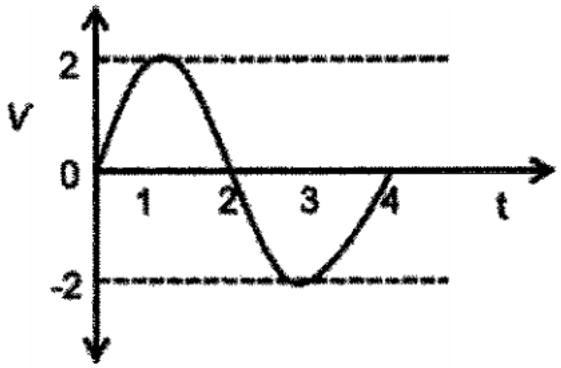
A ½(X)(I_{max}).

B (X)(I_{max}).

C (X) $\frac{I_{max}}{\sqrt{2}}$

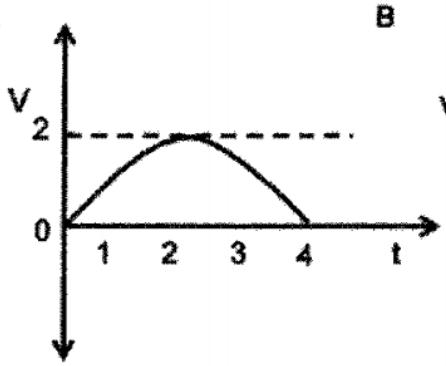
D (X)(I_{max})

8.8 A simple **AC** generator produces a voltage (V) which varies with time (t), as shown in the diagram below.

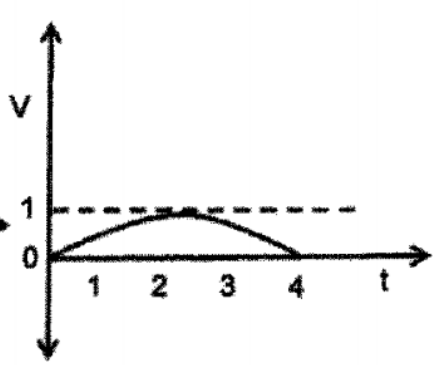


Which ONE of the following graphs shows how the voltage varies with time when the speed of rotation is halved?

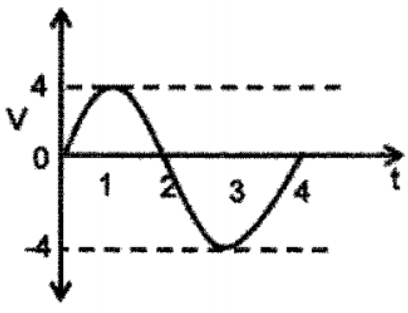
A



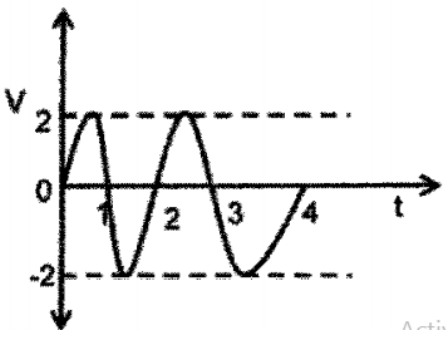
B



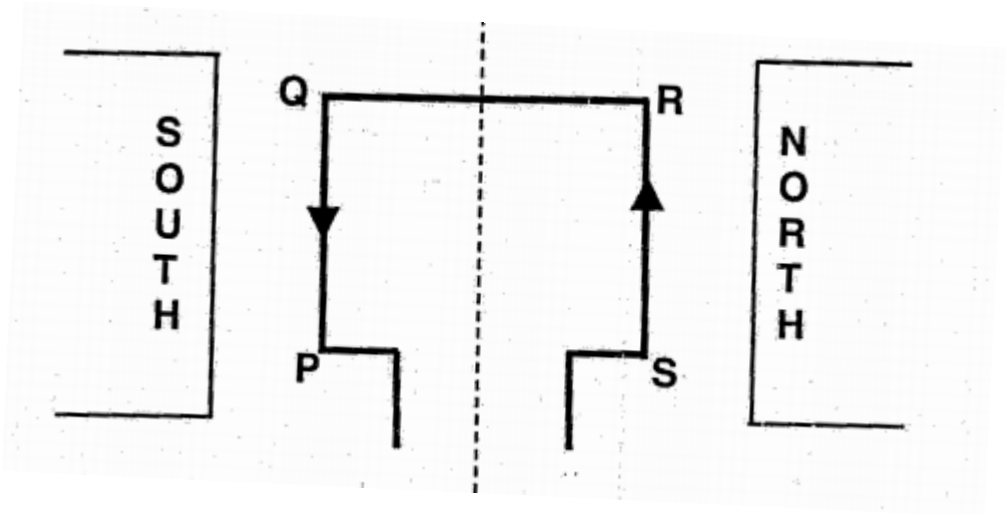
C



D



8.9 A rectangular current carrying coil, **PQRS**, is placed between two bar magnets with the coil parallel to the field as shown below. The arrows indicate the direction of the conventional current.



The coil will…

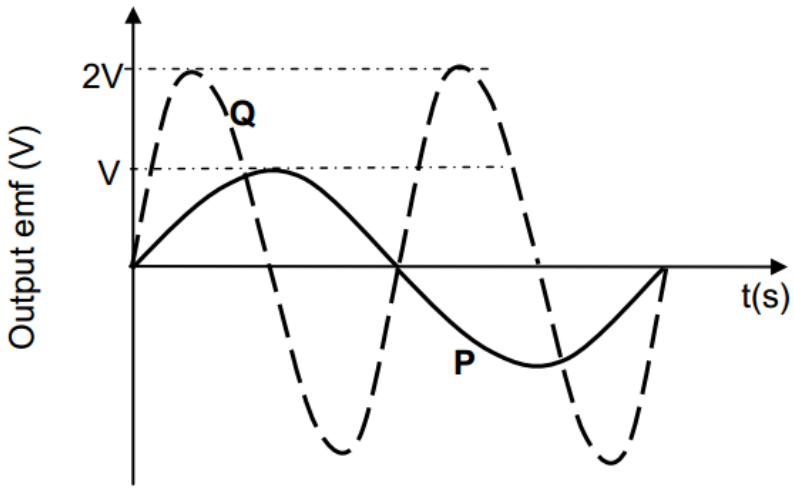
A first rotate clockwise and then anticlockwise.

B rotate clockwise.

C remain motionless.

D rotate anticlockwise.

8.10 Graph **P** represents the output emf of an AC generator. Graph **Q** is the output emf after a change has been made using the SAME generator.



Which ONE of the following changes has been made to the generator to produce graph **Q**?

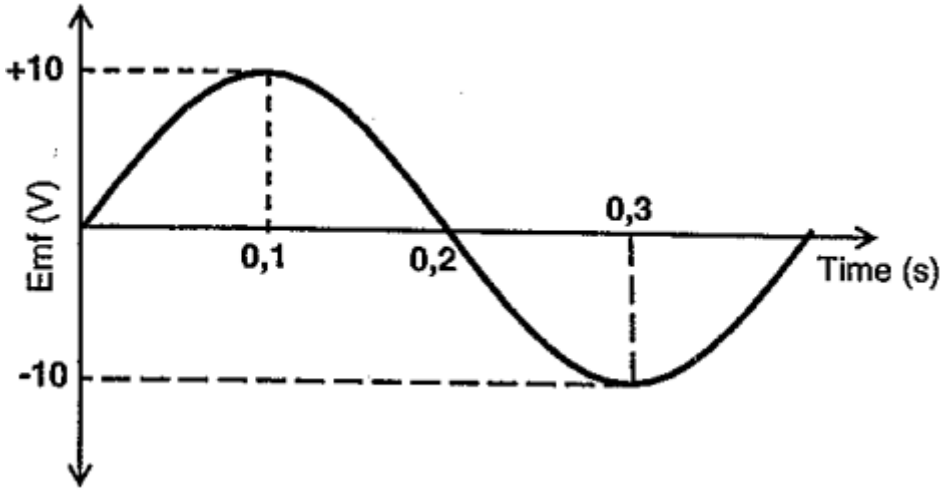
A The number of turns of the coil has been doubled.

B The surface area of the coil has been doubled.

C The speed of rotation has been doubled.

D The strength of the magnetic field has been doubled.

8.11 The graph below shows the change in emf versus time generated by a generator.



If the rotation speed of the generator is DOUBLED, how will this change affect the emf and period represented by the graph?

	Emf	**Period**
A	Larger than 10 V	0,2 s
B	Larger than 10 V	0,1 s
C	10 V	0,1 s
D	Smaller than 10 V	0,4 s

QUESTION 9 (PHOTO ELECTRIC EFFECT)

9.1 The model of light supported by the photoelectric effect is the…

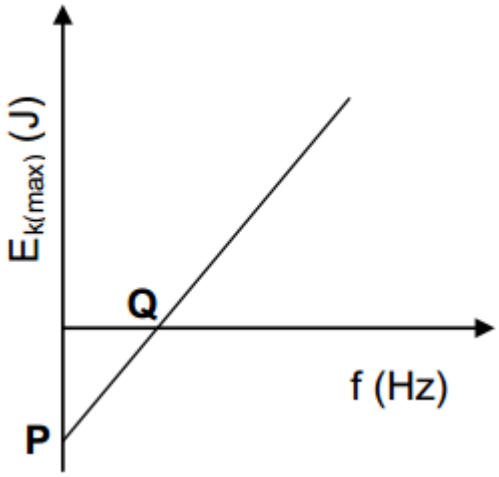
A wave model.

B electron model.

C particle model.

D diffraction model.

9.2 In an investigation on the photoelectric effect, the graph of maximum kinetic energy ($E_{k(max)}$ versus frequency (f) was obtained for a certain metal, as shown below.



The intercepts, **P** and **Q** respectively, represent …

A Planck's constant and threshold frequency.

B work function and threshold frequency.

C threshold frequency and work function.

D threshold frequency and Planck's constant.

9.3 In an experiment on the photoelectric effect, the frequency of the incident light is high enough to cause the removal of electrons from the surface of the metal.

The number of electrons ejected from the metal surface is proportional to the …

A kinetic energy of the electrons.

B number of incident photons.

C work function of the metal.

D frequency of the incident light.

9.4 When a monochromatic light is shone onto a clean cadmium surface, electrons with kinetic energy up to a maximum of 2P are released. The work functions of cadmium is P.

What is the frequency of the photons of this light?

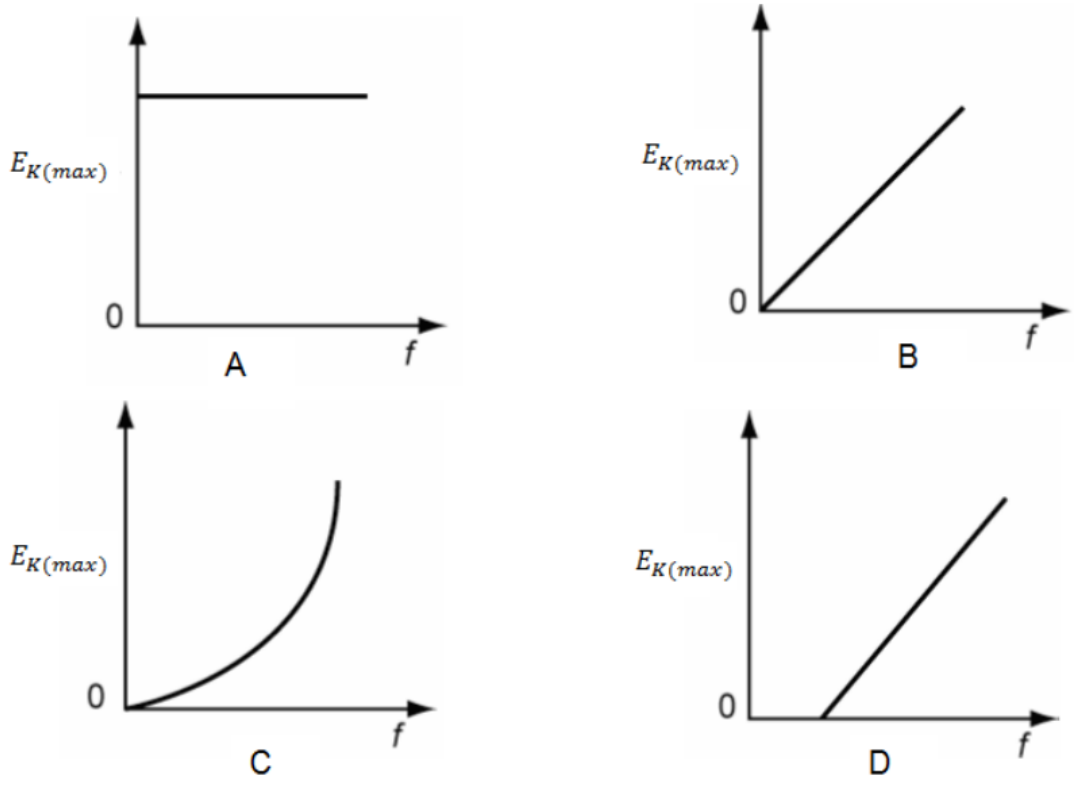
A $\frac{3P}{h}$

B $\frac{P}{h}$

C Ph

D $3Ph$

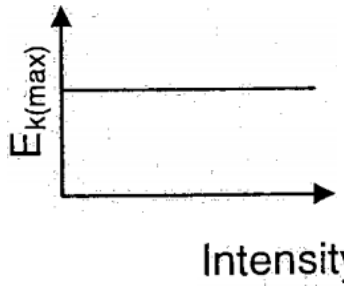
9.5 Which ONE of the following graphs best illustrates the relationship between maximum kinetic energy ($E_{k(max)}$f the emitted electrons from a metal surface and frequency (*f)* of the incident light?



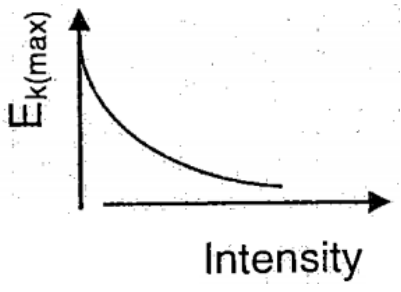
9.6 Ultraviolet light with variable intensity is shone on a metal plate. Photoelectrons are ejected from the surface of the metal plate.

Which ONE of the following graphs shows the correct relationship between the maximum kinetic energy of the ejected photoelectrons and the intensity of the incident light?

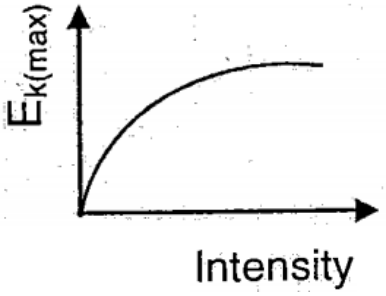
A



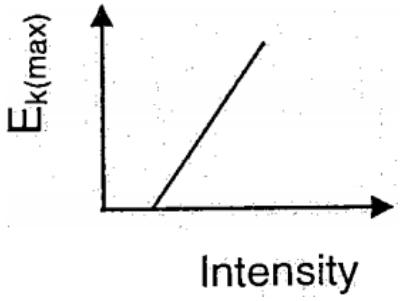
B



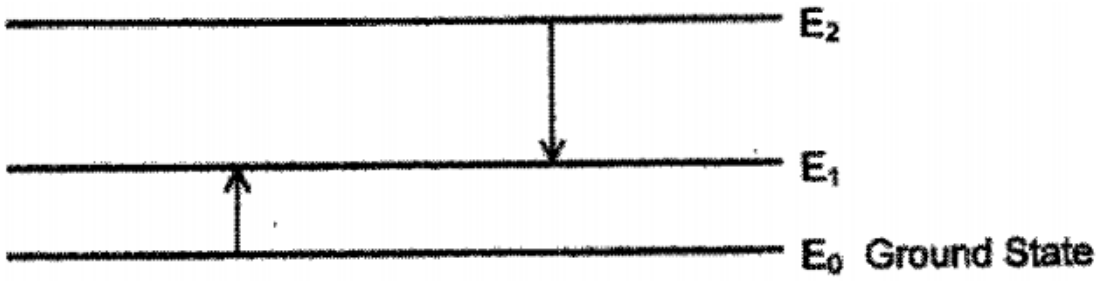
C



D



9.7 The energy level diagram for an element is shown in the diagram below.



The electron transition from E_1 to E_2 corresponds to a green line in the element's spectrum.

The transition from E_0 to E_1 corresponds to the …

A absorption of red light.

B absorption of green light.

C emission of green light.

D emission of red light.

9.8 To see an absorption spectrum, the dispersed light must…

A come straight out of a white hot filament.

B have passed through a gas that is substantially cooler than the source of light.

C have passed through a gas that is substantially hotter than the source of light.

D have passed through a gas that is at the same temperature as the source of light.

9.9 Which one of the following is TRUE concerning the photoelectric effect?

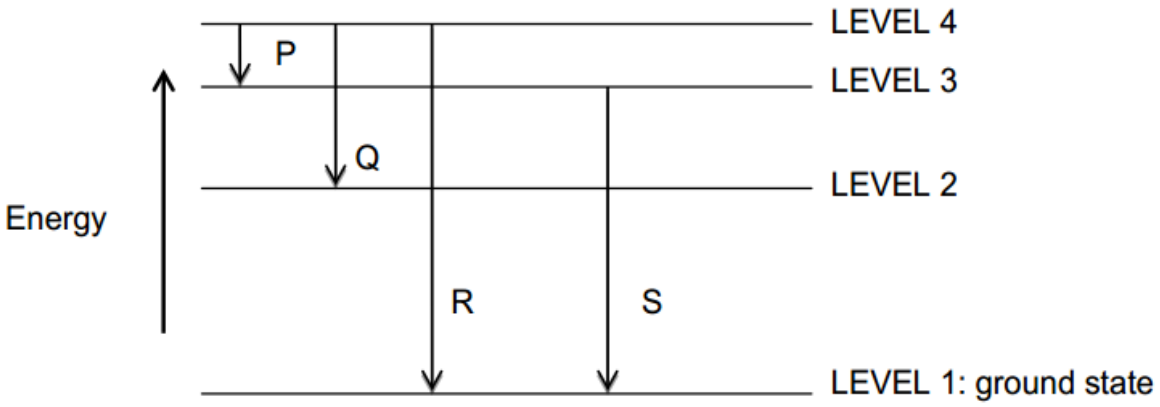
A Light of higher frequency emits electrons with lower kinetic energies.

B If we shine low intensity light with low energy photons on a clean metal surface long enough, electrons will eventually be emitted.

C If we shine high intensity light with low energy photons on a clean metal surface long enough, electrons will eventually be emitted.

D Most metals will emit electrons when ultraviolet light shines on them.

9.10 The possible atomic transitions in an excited atom of an element are shown below.



Which transition will produce the spectral line with the longest wavelength?

A P

B Q

C R

D S

9.11 In an experiment on the photoelectric effect, a scientist shines red light on a metal surface and observes that electrons are ejected from the metal surface. Later the scientist shines blue light, with the same intensity as the red light, on the same metal surface.

Which ONE of the statements below will be the CORRECT observation as a result of this change?

A The number of ejected electrons per second will increase.

B The number of ejected electrons per second will decrease.

C The speed of the ejected electrons will decrease.

D The maximum kinetic energy of the ejected electrons will increase.

9.12 The maximum kinetic energy of an electron ejected from the surface of a metal by a photon depends on:

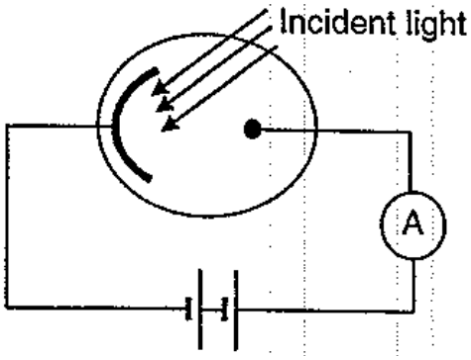
A The photon's frequency only

B The metal's work function only

C Both the photon's frequency and the metal's work function

D The photon's intensity and the metal's work function

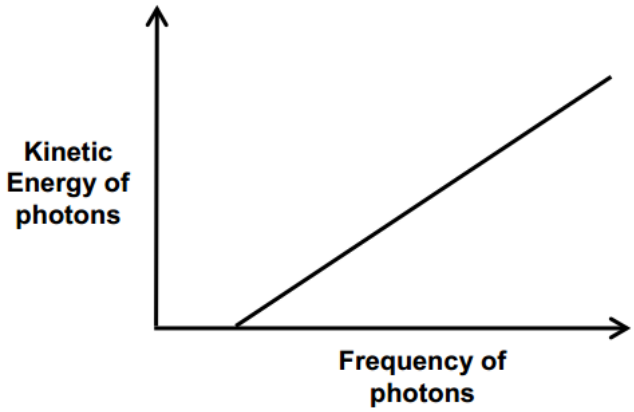
9.13 The diagram below shows light incident on the cathode of a photocell.
The ammeter registers a reading.



The intensity of the incident light is now changed.
Which ONE of the following correctly describes the relationship between the intensity of the incident light and the ammeter reading?

	INTENSITY	**AMMETER READING**
A	Increases	Increases
B	Increases	Remains the same
C	Increases	Decreases
D	Decreases	Increases

9.14 A graph of the kinetic energy of photons of light versus the frequency of the photons is shown below.



What is represented by the gradient of the above graph?

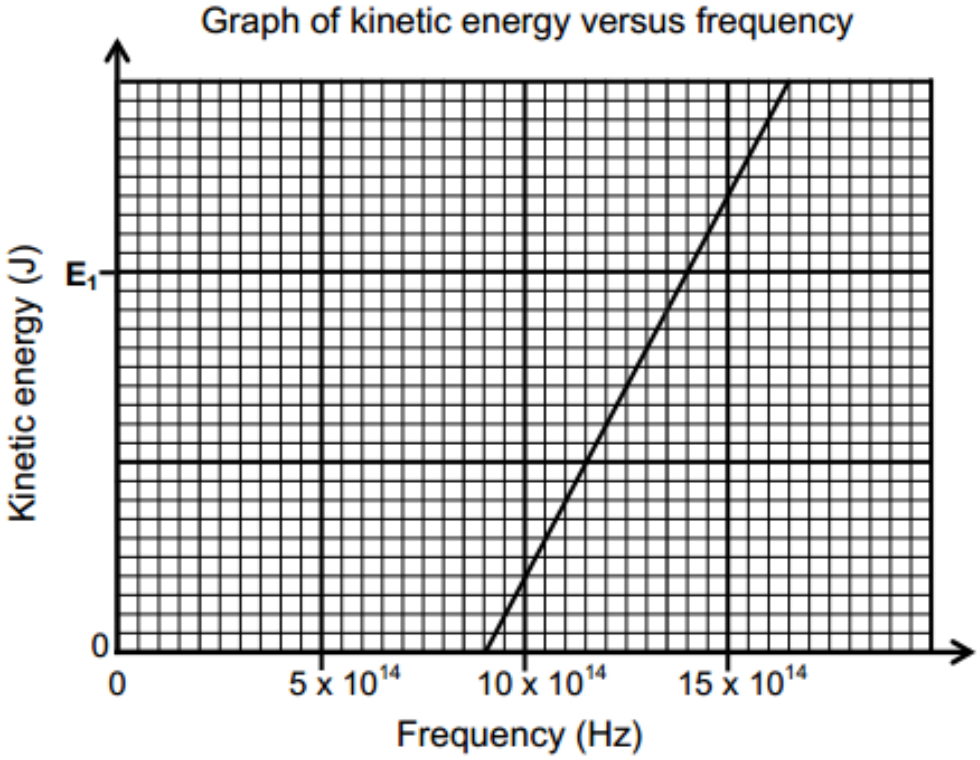
A Plank's Constant

B threshold frequency

C speed of light

D mass of the photon

9.15 During an investigation, light of different frequencies is shone onto the metal cathode of a photocell. The kinetic energy of the emitted photoelectrons is measured. The graph below shows the results obtained.



Which ONE of the following combinations can be deduced from the above graph?

	Independent variable	Threshold frequency (Hz)
A	Frequency	$E_1 \div 5 \times 10^{14}$
B	Kinetic energy	$E_1 \div 5 \times 10^{14}$
C	Kinetic energy	9×10^{14}
D	Frequency	9×10^{14}

9.16 A metallic surface emits photoelectrons when irradiated with green light.

When the green light is replaced by ultraviolet light, the kinetic energy (E_k) of the emitted photoelectrons will …

A increase.
B decrease.
C drop to zero.
D remain the same.

9.17 The wavelength of a monochromatic light source **P** is twice that of a monochromatic light source **Q**. The energy of a photon from source **P** will be … of a photon from source **Q**.

A a quarter of the energy
B half the energy
C equal to the energy
D twice the energy

9.18 The spectrum of an element from a star shows some absorption lines. These lines are produced because …

A atoms absorb energy when moving from an excited state to a lower energy state.
B a cold gas absorbs certain frequencies of light passing through it.
C a hot gas absorbs certain frequencies of light passing through it.
D atoms release energy when moving from an excited state to a lower energy state

9.19 When light of a certain wavelength is incident on a metal surface, no electrons are ejected. Which ONE of the following changes may result in electrons being ejected from the metal surface?

A Increase the intensity of the light.
B Use light with a much shorter wavelength.

C Use metal with a larger work function.

D Increase the surface area of the metal.

9.20 Which ONE of the following provides evidence that light behaves as particles?

A Light can be diffracted.

B Light is refracted by a triangular prism.

C Light ejects electrons from a metal surface.

D The speed of light decreases when it travels from air to glass.

9.21 Which ONE of the following descriptions best explains the formation of a line emission spectrum?

A line emission spectrum is formed when …

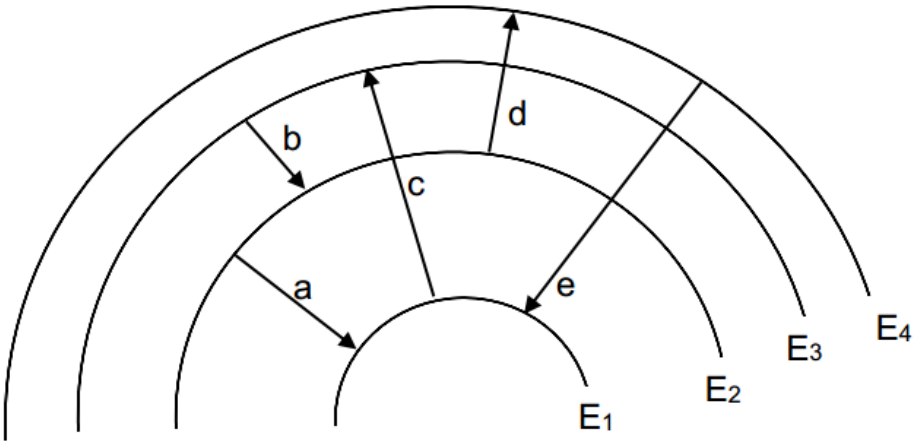
A white light passes through a cold gas.

B white light passes through a triangular prism.

C electrons in the ground state move to a higher energy level.

D electrons in the excited state move to a lower energy level.

9.22 The diagram below shows possible transitions of electrons between ENERGY LEVELS (E_1 to E_4) in an atom of a specific element.



Which transition will produce the line of SHORTEST WAVELENGTH on the emission spectra of the element?

A Transition a

B Transition c

C Transition d

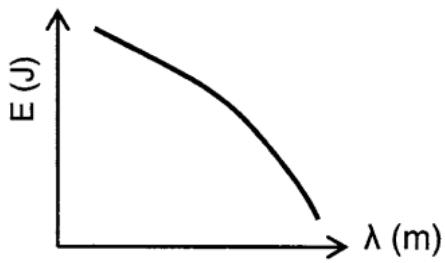
D Transition e

9.23 A bundle of GREEN light is incident on the cathode of a photo-electric cell. The milli-ammeter registers a current in the circuit. The green light is removed and BLUE light with a lower intensity is incident on the same photo-electric cell. How does the amount of photo-electrons released per second and the speed of the photoelectrons compare when BLUE light is used?

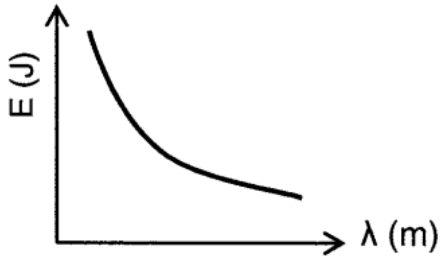
	Amount of photoelectric per second	**Speed of photoelectrons**
A	Decreases	Decreases
B	Increases	Decreases
C	Decreases	Increases
D	Stays the same	Increases

9.24 Which ONE of the following graphs best shows how photon energy (E) varies with the wavelength (λ) of the light?

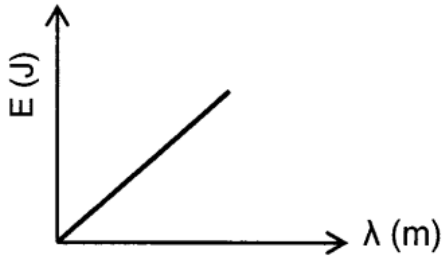
A



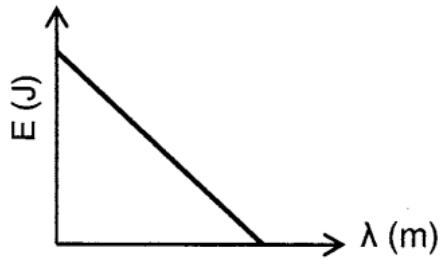
B



C



D



9.25 When light of a certain wavelength is incident on a metal surface, no electrons are ejected. Which ONE of the following changes may result in electrons being ejected from the metal surface?

A Increase the intensity of the light.

B Use light with a much shorter wavelength.

C Use metal with a larger work function.

D Increase the surface area of the metal.

9.26 An excited electron is in energy level 3. The maximum possible emission spectrum lines that this electron can generate is …

A 1

B 2

C 3

D 4