Topic D

Multiple choice questions

1 The gravitational force between two point masses is F. What is the force when both masses are doubled and their separation halved?

A F

B $4F$

C $8F$

D $16F$

2 Two identical solid steel spheres touch. The gravitational force between them is F. The spheres are replaced by two touching solid steel spheres of double the radius. What is the force between the spheres now?

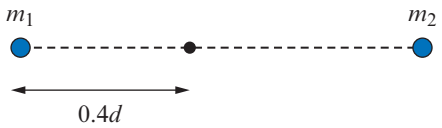
A $\frac{F}{4}$

B $\frac{F}{16}$

C $4F$

D $16F$

3 Two particles of masses m_1 and m_2 are a distance d apart.



The gravitational field strength on the line joining the particles at a distance of $0.4d$ from m_1 is zero. What is the ratio $\frac{m_1}{m_2}$?

A $\frac{2}{3}$

B $\frac{4}{9}$

C $\frac{2}{5}$

D $\frac{3}{5}$

4 The gravitational field strength on the surface of Earth is g. A planet has double the mass and double the radius of Earth. What is the gravitational field strength on the surface of the planet?

A $\frac{g}{4}$

B $\frac{g}{2}$

C g

D $2g$

5 A planet has four times the mass of the Earth, but the acceleration of gravity on the surface is the same as that on Earth. What is the radius of the planet in terms of the Earth radius R?

A $\frac{R}{4}$

B $\frac{R}{2}$

C $2R$

D $4R$

6 A satellite is in a circular orbit around a planet. The orbit radius is 5000 km, and the speed of the satellite is 2.0 km s^{-1}. What is the gravitational field strength at the position of the satellite?

A 0.8 N kg^{-1}

B 4.0 N kg^{-1}

C 8.0 N kg^{-1}

D Cannot be determined without knowing the mass of the planet.

7 The mass of a landing module on the Moon is 2000 kg. The gravitational field strength on the Moon is one-sixth that on Earth. What is the weight of the landing module on Earth?

A 330 N

B 2000 N

C 12 000 N

D 20 000 N

8 A planet has double the radius of Earth and half its density. What is the gravitational field strength on the surface of this planet?

A 5.0 N kg^{-1}

B 10 N kg^{-1}

C 20 N kg^{-1}

D 40 N kg^{-1}

9 A planet has radius R. The gravitational field strength at a height R from the surface is g.
What is the gravitational field strength at a point whose height from the planet's surface is $2R$?

A $\frac{g}{4}$

B $\frac{4g}{9}$

C $\frac{g}{2}$

D $\frac{2g}{3}$

10 A satellite orbits the Earth in a circular orbit. The only force on the satellite is the gravitational force from the Earth. Which of the following is correct about the acceleration of the satellite?

A It is zero.

B It is constant in magnitude and direction.

C It is constant in magnitude but not in direction.

D It is not constant in magnitude or direction.

11 A satellite is in a circular orbit around the Earth. The satellite enters an orbit further away from the surface. What change took place?

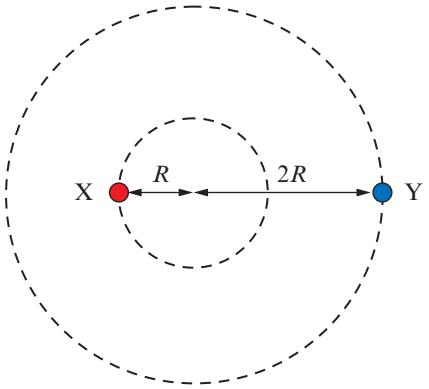
A The satellite's speed decreased.

B The satellite's speed increased.

C The satellite's mass decreased.

D The satellite's mass increased.

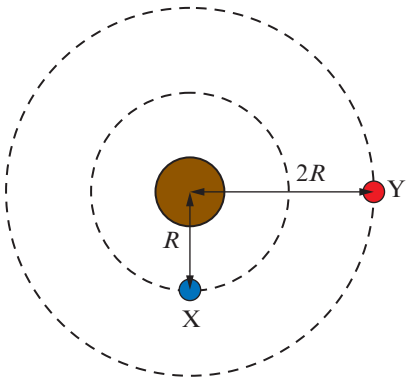
12 Two stars, X and Y, orbit a common centre. X and Y are always diametrically opposite each other. X has an orbit radius R and Y an orbit radius $2R$. The period of revolution of X is T and its speed is v.



What are the period and speed of Y?

	Period of Y	Speed of Y
A	T	v
B	T	$2v$
C	$2T$	v
D	$2T$	$2v$

13 Two satellites, X and Y, orbit a planet in circular orbits of radius R and $2R$.



What is the ratio of their speeds and the ratio of their accelerations?

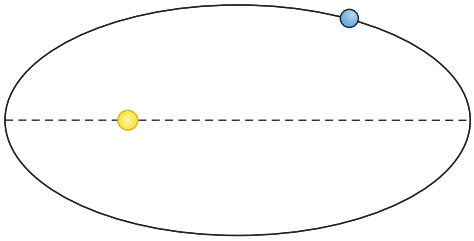
	$\frac{v_X}{v_Y}$	$\frac{a_X}{a_Y}$
A	$\sqrt{2}$	2
B	$\sqrt{2}$	4
C	$\frac{1}{\sqrt{2}}$	2
D	$\frac{1}{\sqrt{2}}$	4

14 The two spherical bodies in the diagram have the same radius. The sphere on the left has twice the mass of the sphere on the right. At which point, A, B, C or D, does the net gravitational field strength of the two masses have the greatest magnitude? A, B, C and D are points on the surfaces of the spheres as shown.

15 Which of Kepler's laws of planetary motion can be derived from Newtonian mechanics?

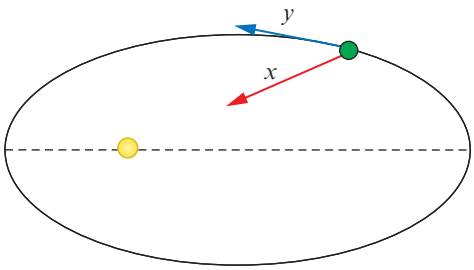
A first
B second
C third
D all three.

16 A planet moves anticlockwise around the Sun in an elliptical orbit.



Which diagram shows the net force (arrow x) and velocity (arrow y) of the planet?

A



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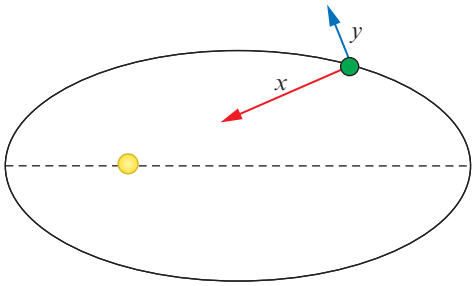

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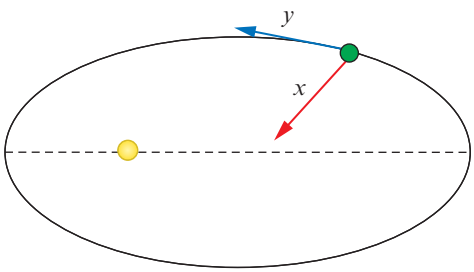

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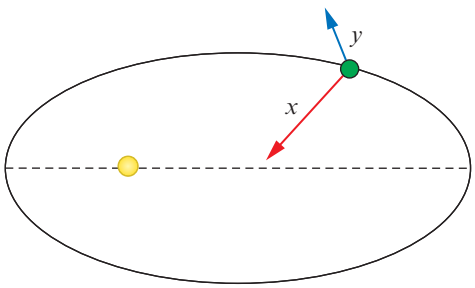
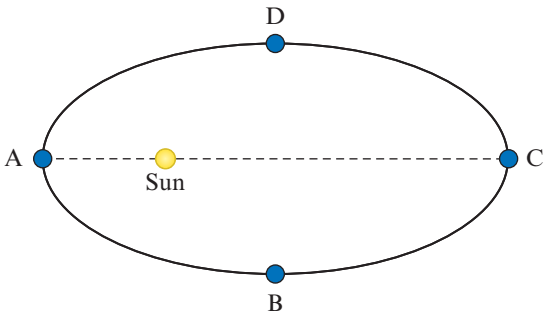
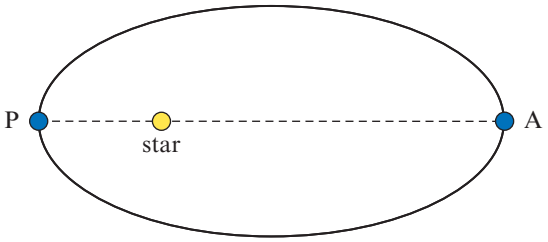


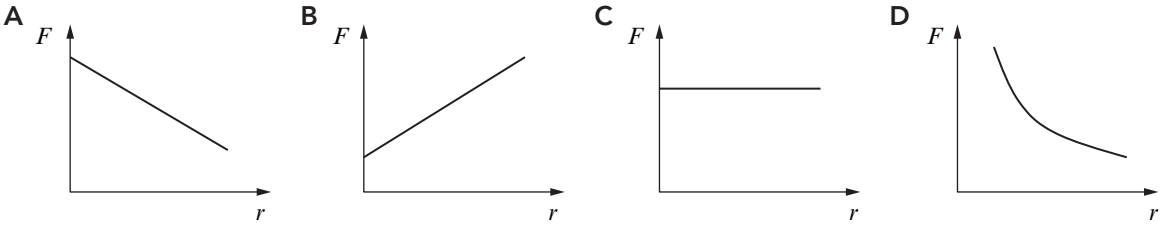
17 A planet is in an elliptical orbit around the Sun. At which point in the orbit is the acceleration of the planet the largest?



18 A planet is in an elliptical orbit around a star.



Which graph shows the variation with distance from the star of the force experienced by the planet as the planet moves from P to A?



19 A planet of mass M orbits a star in a circular orbit of radius R. The period of revolution is T. A second planet of mass $2M$ orbits the same star in a circular orbit of radius $4R$. What is the period of revolution of the second planet?

A $2T$
B $4T$
C $8T$
D $16T$

20 A planet orbits a star in a circular orbit of radius R. The period of revolution is T. A second planet orbits the same star in a circular orbit with period of revolution $27T$. What is the radius of the orbit of the second planet?

A $\frac{R}{3}$
B $3R$
C $9R$
D $81R$

21 A planet has double the mass of the Earth and double the radius. The gravitational potential at the surface of the Earth is V and the magnitude of the gravitational field strength is g. The gravitational potential and gravitational field strength on the surface of the planet are:

	Potential	Field
A	V	$\frac{g}{4}$
B	V	$\frac{g}{2}$
C	$2V$	$\frac{g}{2}$
D	$2V$	$\frac{g}{4}$

22 Two uniform spheres, each of mass M, have their centres a distance d apart. Which of the following is true at the point midway on the line joining the two centres?

	Potential	Gravitational field strength
A	Non-zero	Zero
B	Non-zero	Non-zero
C	Zero	Zero
D	Zero	Non-zero

23 A probe of mass m is in a circular orbit of radius r around a planet of mass M. The probe is moved to a higher circular orbit of orbit radius $2r$. What is the work done on the probe?

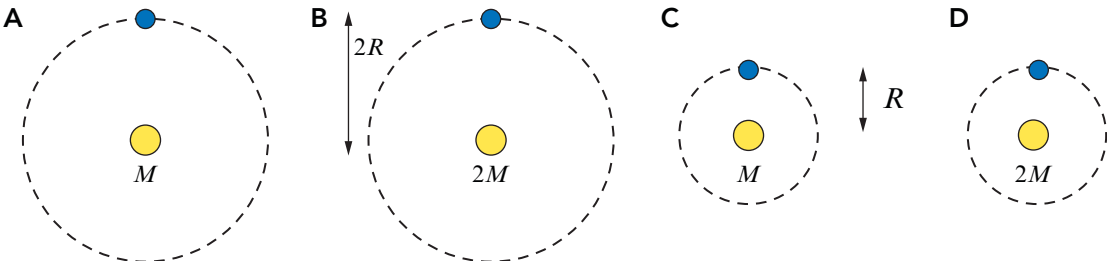
A $-\frac{GMm}{2r}$

B $\frac{GMm}{2r}$

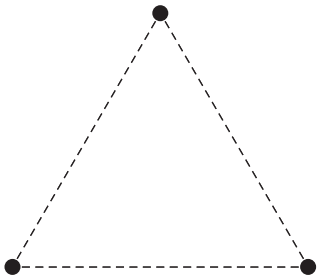
C $-\frac{GMm}{4r}$

D $\frac{GMm}{4r}$

24 Four identical satellites orbit four planets. The mass of each planet and the orbit radius of the satellite are shown. Which satellite has the least total energy?



25 Three identical spheres each of mass M are at the vertices of an equilateral triangle of side d.



What is the gravitational potential energy of this arrangement?

A $-\frac{GM^2}{d}$

B $-\frac{3GM^2}{d}$

C $-\frac{GM}{d}$

D $-\frac{3GM}{d}$

26 A satellite in a low circular orbit experiences a small frictional force. What is the effect of this force on the kinetic energy and the period of revolution of the satellite?

	Kinetic energy	Period
A	Decreases	Decreases
B	Decreases	Increases
C	Increases	Decreases
D	Increases	Increases

27 A planet without an atmosphere has mass M and radius R. An object is released from rest at a height R above the surface of a planet. What is the speed with which the object impacts the surface of the planet?

A $\sqrt{\frac{GM}{2R}}$

B $\sqrt{\frac{GM}{R}}$

C $\sqrt{\frac{2GM}{R}}$

D $2\sqrt{\frac{GM}{R}}$

28 A probe of mass m is launched from the surface of a planet without an atmosphere of mass M and radius R with kinetic energy $\frac{3GMm}{5R}$. What is the maximum **height above the surface** of the planet that this probe will reach?

A $\frac{2R}{5}$

B $\frac{7R}{5}$

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

D $\frac{5R}{2}$

29 A probe of mass m is launched from the surface of a planet without an atmosphere of mass M and radius R with kinetic energy $\frac{4GMm}{5R}$. The probe settles into a circular orbit around the planet. What is the radius of the orbit?

A $\frac{5R}{4}$
B $\frac{3R}{2}$
C $\frac{5R}{2}$
D $5R$

30 The escape speed from the surface of Earth is v_{esc}. What is the escape speed from the surface of a planet without an atmosphere whose mass and radius are both double those of the Earth?

A v_{esc}
B $2v_{esc}$
C $4v_{esc}$
D $8v_{esc}$

31 The escape speed from the surface of Earth is v_{esc}. What is the escape speed from the surface of a planet without an atmosphere whose density and radius are both double those of the Earth?

A $v_{esc}\sqrt{2}$
B $v_{esc}\sqrt{8}$
C $4v_{esc}$
D $8v_{esc}$

32 A probe of mass m is launched from the surface of a planet of radius R. The gravitational field strength at the surface of the planet is g. What is the minimum kinetic energy at launch so that the probe escapes?

A $\frac{mgR}{4}$
B $\frac{mgR}{2}$
C mgR
D $2mgR$

33 Two identical point particles have mass m and charge q. They are separated by a distance d. The electric force between them is F. What is the electric force between the particles if their mass, charge and separation are all doubled?

A $\frac{F}{4}$
B $\frac{F}{2}$
C F
D $2F$

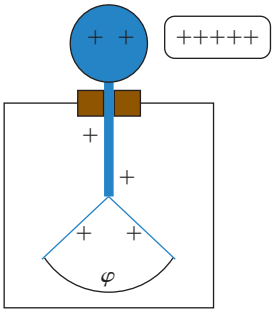
34 The electric force between two particles X and Y each of charge q is F. The charge on particle X is doubled, and the separation of the charges is halved. What is the electric force on X and Y?

	Force on X	Force on Y
A	$4F$	$4F$
B	$4F$	$8F$
C	$8F$	$4F$
D	$8F$	$8F$

35 X and Y are two identical conducting spheres. X has charge Q, and Y is initially uncharged. Y is grounded and is then allowed to touch X. The ground is removed, and the spheres are separated. What is the charge on each sphere?

	Charge on X	Charge on Y
A	0	0
B	$\frac{Q}{2}$	$\frac{Q}{2}$
C	Q	0
D	0	Q

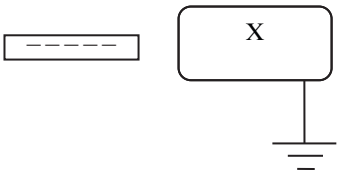
36 An electroscope is positively charged. The angle between the leaves is φ. A positively charged rod is placed close to the electroscope.



What will happen to φ?

A It will become zero.
B It will decrease but stay non-zero.
C It will increase.
D It will stay the same.

37 A negatively charged rod is placed close to a conducting body X that is initially uncharged. The body is then grounded briefly, and the ground is then removed.



The rod is then also removed. Which is correct for the body?

A No part of the body has a net charge.
B The left end of the body has a positive charge and the right end an equal negative charge.
C The body is negatively charged.
D The body is positively charged.

38 X and Y are two identical conducting spheres with their centres a distance d apart. X has charge Q and Y has charge $2Q$. The force between them is F. The spheres touch and are then moved to their original separation. What is the force between the spheres now?

A 0
B $\frac{3}{4}F$
C $\frac{9}{8}F$
D $\frac{9}{4}F$

39 A small charge q is placed near a large spherical charge Q. The force experienced by both charges is F. The electric field created by Q at the position of q is

A $\frac{F}{Q}$

B $\frac{F}{q}$

C $\frac{F}{Qq}$

D $\frac{FQ}{q}$

40 A positive charge q is placed half-way between two long parallel plates that are separated by a distance $2d$. The charge on one of the plates is Q and the charge on the other plate is $-Q$. The potential difference between the plates is V. What is the magnitude of the force on the charge q?

A $k\frac{Qq}{d^2}$

B $k\frac{2Qq}{d^2}$

C $\frac{qV}{2d}$

D $\frac{qV}{d}$

41 The electric field strength at the surface of a sphere of charge Q and radius R is E. Another sphere has charge $2Q$ and radius $2R$. What is the electric field strength at the surface of this sphere?

A $2E$

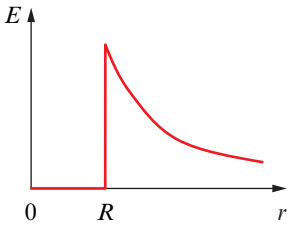
B E

C $\frac{E}{2}$

D $\frac{E}{4}$

42 A spherical conductor of radius R is positively charged. Which graph shows how the electric field strength E varies with distance r from the centre of the conductor?

A



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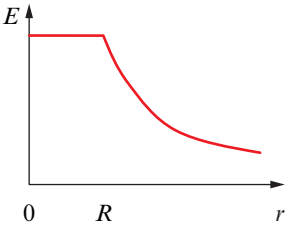

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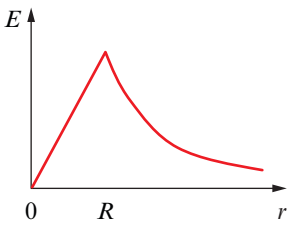

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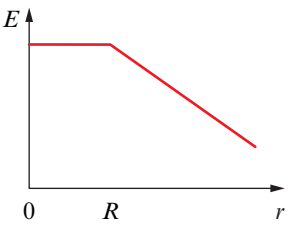
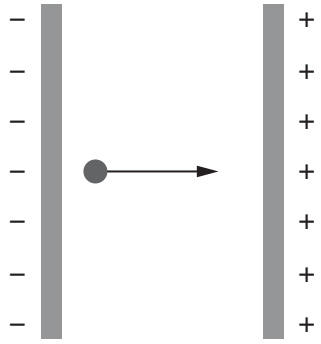
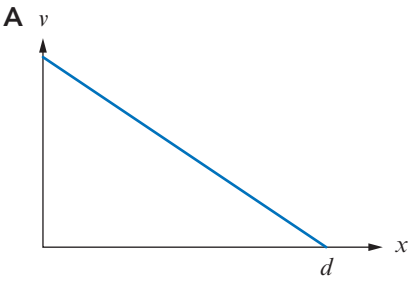


43 The diagram shows two oppositely charged parallel plates a distance d apart.

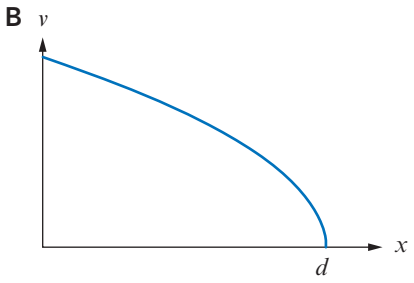


A proton is launched from the negative plate. The proton just reaches the positive plate. Which graph represents the variation of the speed v of the proton with distance x from the negative plate?

A



B



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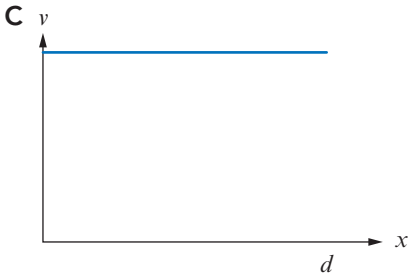

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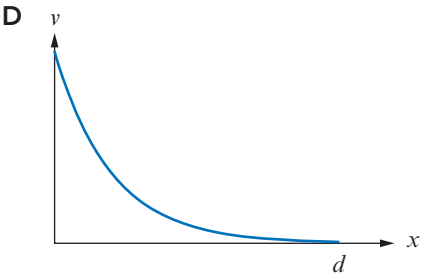
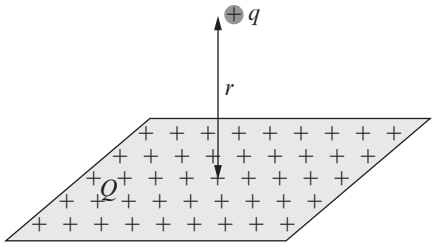


44 An amount of positive charge Q is placed uniformly on a large plane surface. A small positive point charge q placed a perpendicular distance r from the surface experiences a force F.



What is the magnitude of the electric field at the position of the small charge q?

A $\frac{kQ}{r^2}$

B $\frac{kq}{r^2}$

C $\frac{F}{Q}$

D $\frac{F}{q}$

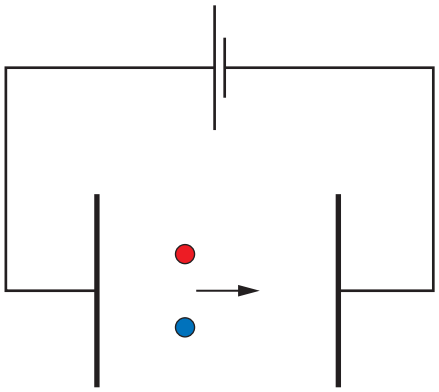
45 A point charge q is placed near a neutral conducting sphere. What is correct about the electric force between the point charge and the sphere?

A The force is zero.
B The force is always attractive.
C The force is always repulsive.
D The force is attractive or repulsive depending on the sign of q.

46 Where does a non-zero electric field exist?

A near the north pole of a bar magnet
B near a wire carrying a constant current
C outside two infinitely long, oppositely charged, parallel plates
D near a point electric charge.

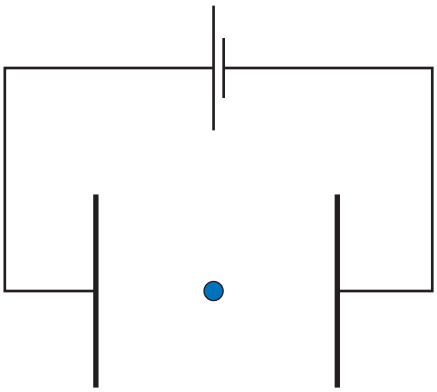
47 Two charged particles are released from rest from the middle of two parallel, oppositely charged plates.



The particles reach the right plate in the same time. It may be deduced that the particles have the same

A charge
B mass
C charge to mass ratio
D charge and mass.

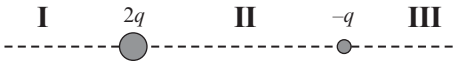
48 A charged particle is placed at the middle of two parallel, oppositely charged plates.



The electric force on the particle is F. The charge on the particle is doubled, and the separation of the plates is halved. What is the electric force on the particle?

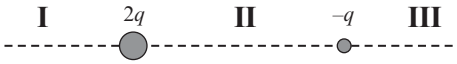
A $\frac{F}{4}$
B F
C $2F$
D $4F$

49 Two charged particles are fixed as shown. Their charges are $2q$ and $-q$. In which regions can the electric field strength due to the two particles be zero?



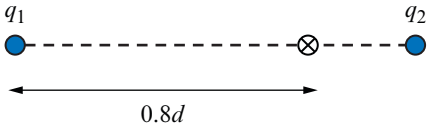
A I only
B II only
C III only
D I and III.

50 Two charged particles are fixed as shown. Their charges are $2q$ and $-q$. In which regions can we find points where the electric field strength is directed to the left?



A I only
B II only
C III only
D I and III.

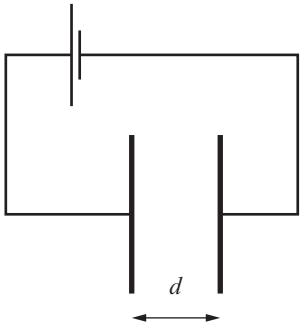
51 Two positively charged particles of charges q_1 and q_2 are a distance d apart.



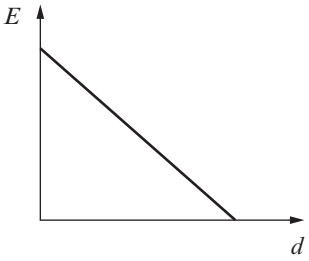
The electric field on the line joining the particles at a distance of $0.8d$ from q_1 is zero. What is the ratio $\frac{q_1}{q_2}$?

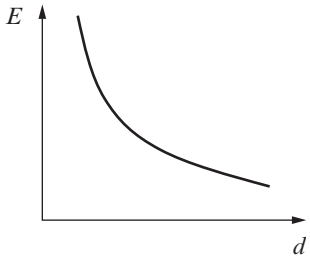
A 2
B 4
C 16
D 32

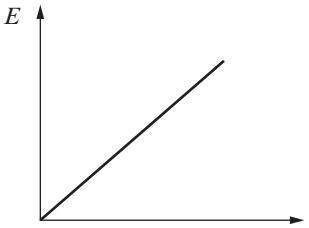
52 Two oppositely charged plates are separated by a distance d.

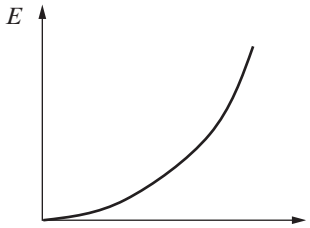


Which graph shows the variation of the electric field strength in between the plates as d is varied?

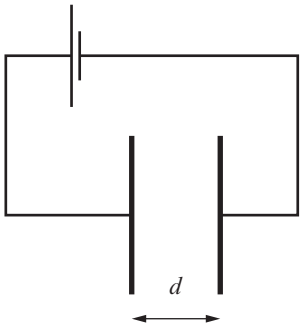
A


B


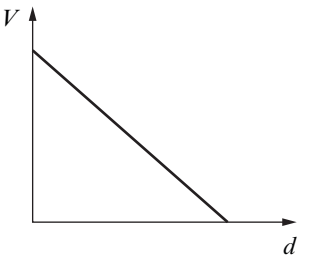
C


D


53 Two oppositely charged plates are separated by a distance d.



Which graph shows the variation of the potential difference between the plates as d is varied?

A


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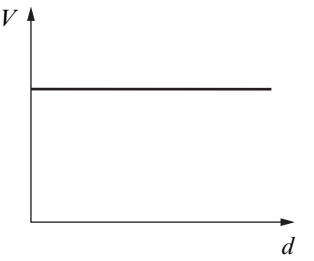
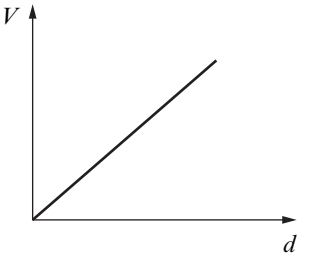
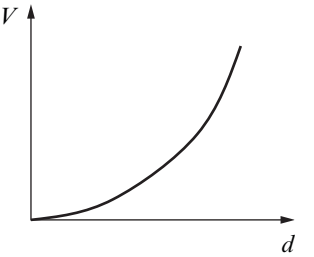
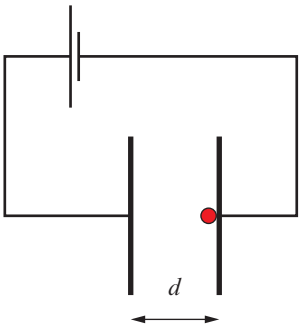


C


D


54 Two oppositely charged plates are separated by a distance d.



The work done by the electric field to move a negative point charge from the negative to the positive plate is W. The time taken is T. The distance d is doubled. What is the work done in moving the same point charge from one plate to the other, and how long does this take?

	Work done	Time taken
A	W	$T\sqrt{2}$
B	W	$2T$
C	$2W$	$T\sqrt{2}$
D	$2W$	$2T$

55 A particle of mass m and charge q is accelerated from rest by a potential difference V.
What is the speed acquired by the particle?

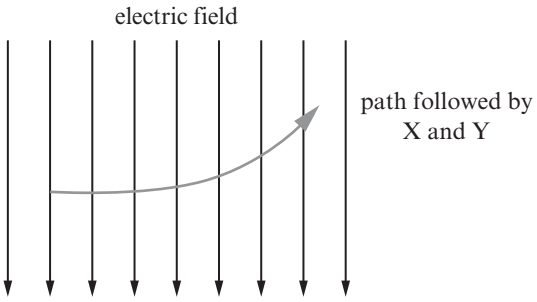
A $\sqrt{\frac{2qV}{m}}$

B $\frac{2qV}{m}$

C $\sqrt{\frac{m}{2qV}}$

D $\frac{m}{2qV}$

56 Two charged particles X and Y are projected horizontally with the same speed from the same point in a uniform electric field. Gravity is not negligible.



The two particles follow identical paths. What conclusion about X and Y can one draw from this?

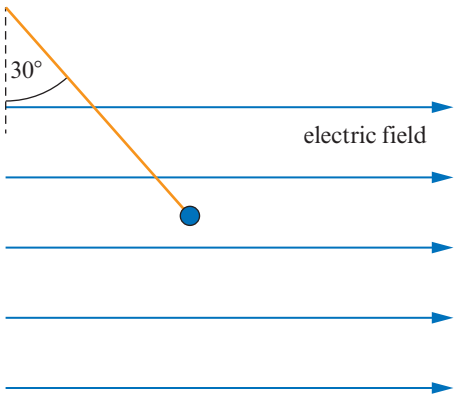
A They have the same mass.

B They have the same charge.

C They have the same acceleration.

D They have the same momentum.

57 A positively charged particle is attached to a string and placed in a uniform horizontal electric field. The particle is in equilibrium when the string makes an angle of 30° to the vertical.



The string is cut. What is the path of the charged particle while it is in the electric field?

A a parabolic path
B a horizontal straight line
C a vertical straight line
D a straight line at 30° to the vertical.

58 A charged particle moves in a circle of radius R in a uniform magnetic field. The magnetic field is at right angles to the velocity of the particle and exerts a force F on the particle. After half a revolution the change in the particle's kinetic energy is

A 0
B πRF
C $2\pi RF$
D RF

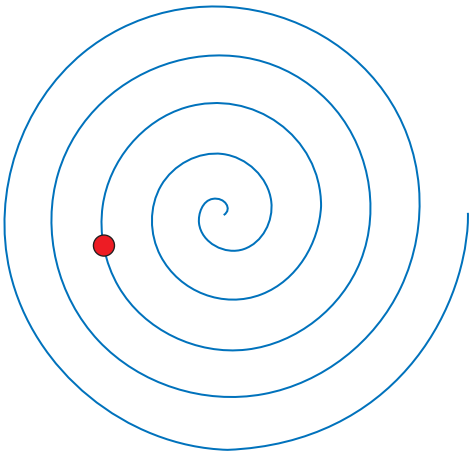
59 A negatively charged particle is at rest in a magnetic field B. The magnetic force on the particle is

A parallel to B
B opposite to B
C at right angles to B
D zero.

60 A charged particle moves in a circle in a magnetic field. The particle completes one revolution in time T. The speed of the particle is doubled. What is the time for one revolution?

A $\frac{T}{4}$
B $\frac{T}{2}$
C T
D $2T$

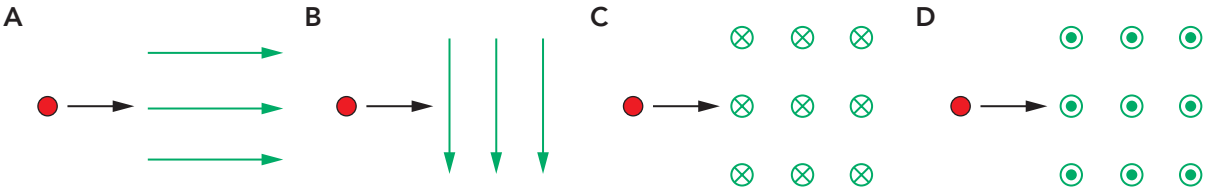
61 The diagram shows an electron moving in air in a magnetic field that is at right angles to the plane of the page.



What is the direction of motion of the electron and the direction of the magnetic field?

	Field	Magnetic field
A	Clockwise	Into the page
B	Clockwise	Out of the page
C	Anticlockwise	Into the page
D	Anticlockwise	Out of the page

62 An electron enters a magnetic field. In which case is the initial force on the electron directed towards the bottom of the page?



63 A length of wire carrying current I is in a magnetic field of magnetic flux density B. The force on the wire is F. What is the force when the current is doubled and the magnetic flux density becomes $\frac{B}{4}$?

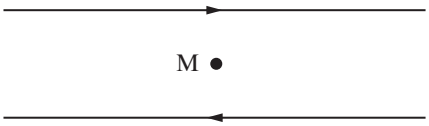
A $\frac{F}{4}$

B $\frac{F}{2}$

C $2F$

D $4F$

64 Two long parallel wires carry equal currents in opposite directions. What field do the two wires produce at point M, which is midway between the wires and on the plane of the paper?

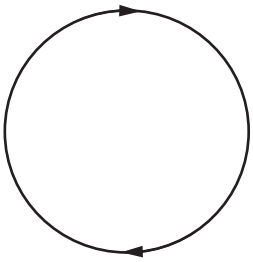


A a magnetic field parallel to the wires
B an electric field parallel to the wires
C a magnetic field at right angles to the plane of the paper
D an electric field at right angles to the plane of the paper.

65 An alpha particle, a proton, a neutron and an electron move at the same speed at right angles to a magnetic field. Which particle experiences the least magnetic force?

A the alpha particle
B the proton
C the neutron
D the electron.

66 A loop of wire on the plane of the page carries a clockwise current.



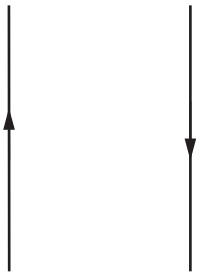
The magnetic field created by this current at the centre of the loop is

A zero
B directed into the plane of the page
C directed out of the plane of the page
D directed towards the top of the page.

67 The Tesla is equivalent to which combination of units?

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

68 Two parallel wires carry currents in opposite directions. The force per unit length on each wire is f.



The currents and the separation of the wires are all doubled. What is the force per unit length on the wires?

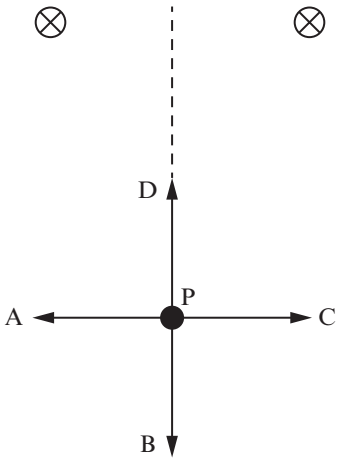
A f
B $2f$
C $\frac{f}{2}$
D $\frac{f}{4}$

69 An electron moves near a bar magnet as shown.

What is the direction of the magnetic force on the electron?

A towards the top of the page
B towards the bottom of the page
C into the page
D out of the page.

70 Two parallel wires carry the same current into the plane of the page. Point P is equidistant from the wires. What is the direction of the magnetic flux density at P?

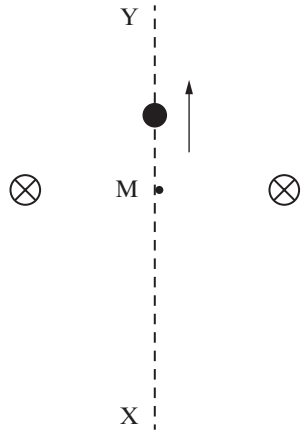


71 Four parallel and equidistant wires, P, Q, R and S, carry equal currents into the page.

The force per unit length P exerts on Q is f. What is the net force per unit length on R?

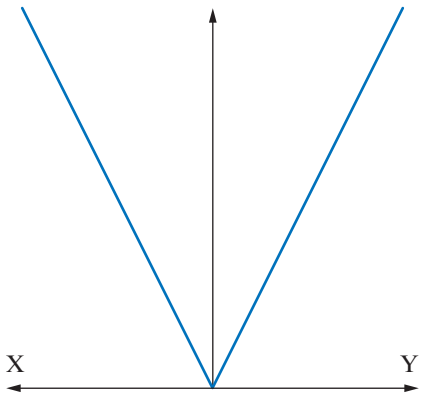
	Magnitude	Direction
A	$\frac{f}{2}$	Left
B	$\frac{f}{2}$	Right
C	f	Left
D	f	Right

72 Two parallel wires carry the same current into the plane of the page. A proton has constant speed and can be placed anywhere on the dotted line from X to Y.

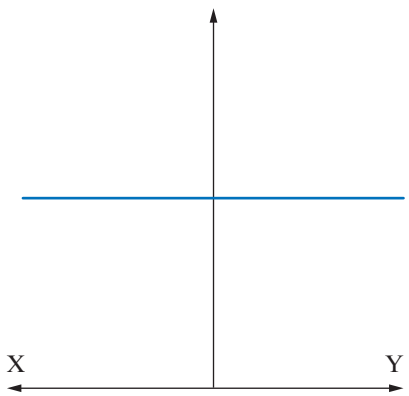


Which graph best represents the variation of the *magnitude* of the magnetic force exerted on the proton with position x from point M?

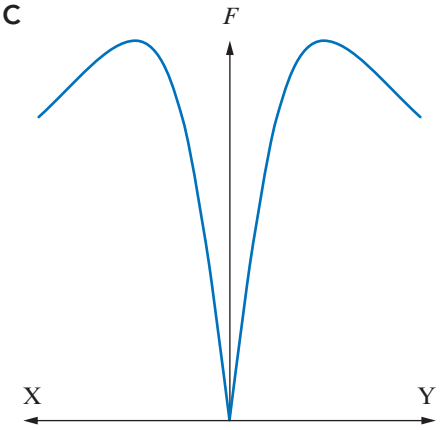
A



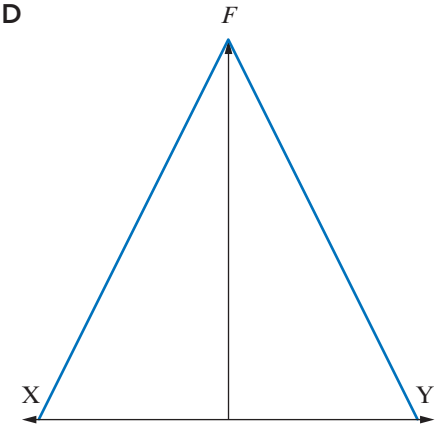
B



C



D



73 The north pole of a bar magnet attracts each end of a metal cylinder. What can be concluded about the cylinder from this observation?

A It is a bar magnet with two south poles.

B It is a bar magnet with two north poles.

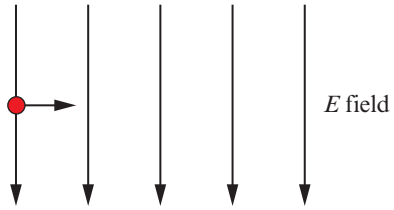
C It is a bar magnet with one south and one north pole.

D It is made from a material that can be magnetized.

74 A charged particle moves in a field. The force on the particle due to the field is opposite to the field. What is correct about the nature of the field and the sign of the charge on the particle?

	Field	Charge
A	Electric	Positive
B	Electric	Negative
C	Magnetic	Positive
D	Magnetic	Negative

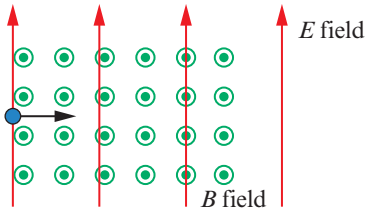
75 An electron enters an electric field of electric field strength E, with an initial velocity v that is normal to the field.



What is the magnitude and direction of a magnetic field that will allow the electron to continue through the electric field undeflected?

	Magnitude	Direction
A	vE	Into the plane of the page
B	vE	Out of the plane of the page
C	$\frac{E}{v}$	Into the plane of the page
D	$\frac{E}{v}$	Out of the plane of the page

76 A proton, of speed v, enters a region of electric and magnetic fields at right angles to each other. The direction of the magnetic field is out of the page.

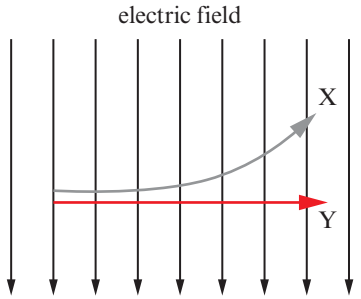


The proton is not deflected.

An alpha particle and an electron enter the same region with the same speed v.
What is correct about the path of the alpha particle and the path of the electron?

	Alpha particle	Electron
A	Deflected	Deflected
B	Deflected	Undeflected
C	Undeflected	Deflected
D	Undeflected	Undeflected

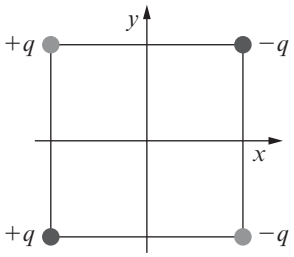
77 A charged particle X is projected horizontally from a point in a vertical electric field. The particle follows a parabolic path. A second particle Y is projected with the same speed and follows a horizontal straight line path. For both particles, gravity is **not** negligible.



What is correct for particle Y?

A It is electrically neutral.
B It is positively charged.
C It is more massive than X.
D The electric force is cancelled by the weight.

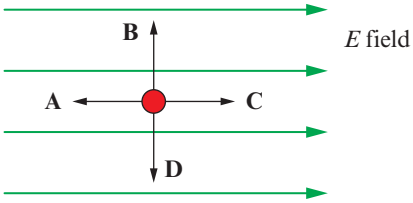
78 Four charges that are equal in magnitude are put at the vertices of a square, as shown in the diagram.



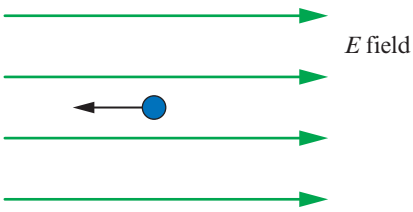
Where is the electric potential zero?

A at the origin only
B along the x-axis
C along the y-axis
D along both axes.

79 A negative charge is in a uniform electric field. In which direction should the charge be moved in order to decrease its potential energy?



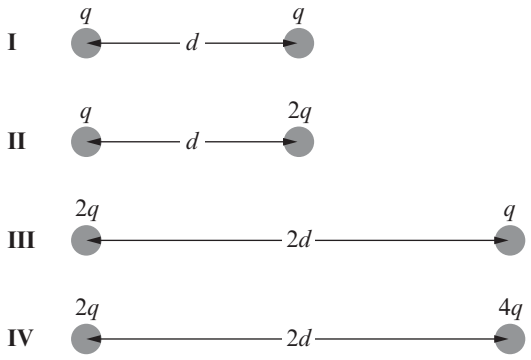
80 A positively charged particle moves in a direction opposite to a uniform electric field.



As the particle moves to the left it experiences

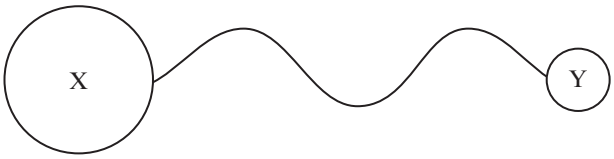
A an increase in kinetic energy
B an increase in potential energy
C a decrease in the electric force
D a decrease in the acceleration.

81 The diagram shows four arrangements of two positive point charges separated by various distances. Which **two** arrangements result in the same electric potential energy?



A I and II
B II and IV
C III and IV
D I and III.

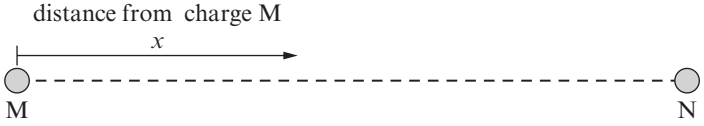
82 Sphere X has radius 10 cm and has charge 15 nC. Sphere Y, which is far from X, has radius 5.0 cm and is uncharged. The spheres are then joined by a conducting wire.



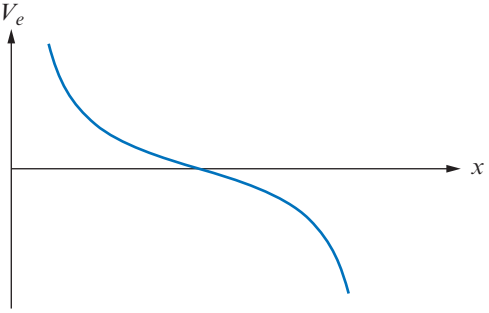
What is the charge on each sphere after the connection?

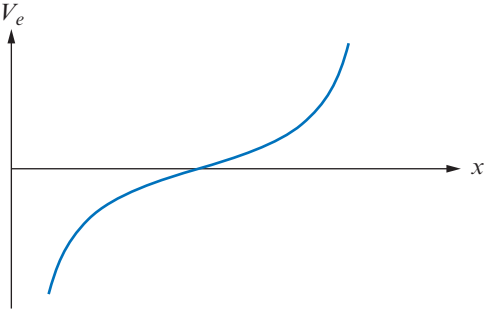
	X	Y
A	12 nC	3.0 nC
B	3.0 nC	12 nC
C	10 nC	5.0 nC
D	5.0 nC	10 nC

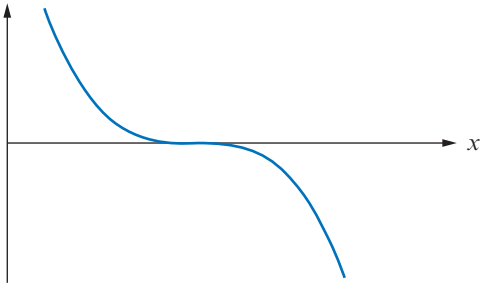
83 Two charges, M and N, are separated by a certain distance.

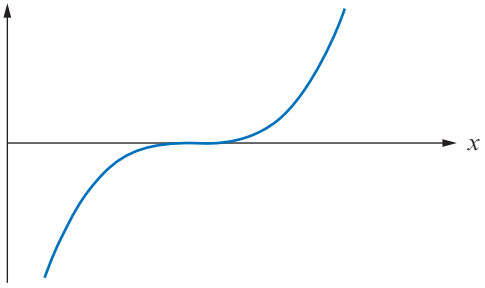


Which graph shows the correct variation of the electric potential V_e with distance x from the centre of charge M for the case of two equal and opposite charges and M positive?

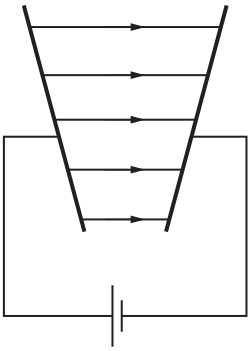
A 

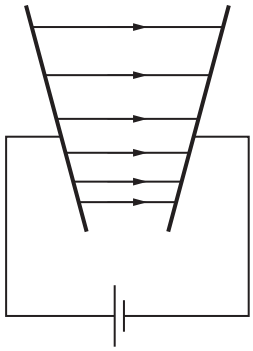
B 

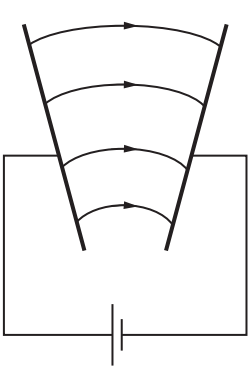
C 

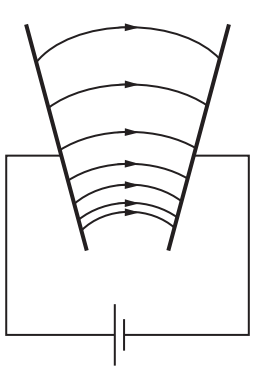
D 

84 Each diagram shows two oppositely charged plates which are not parallel. Which diagram best shows the electric field lines in between the plates?

A 

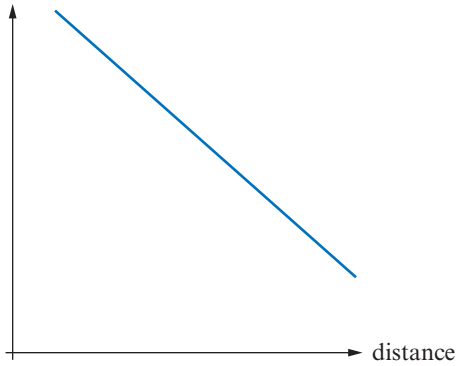
B 

C 

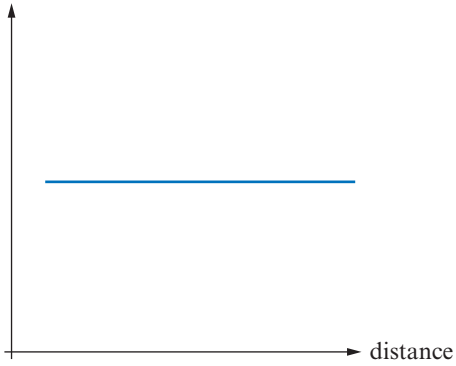
D 

85 A positive point charge is released from rest on the surface of a positively charged sphere. Which graph shows the variation of the sphere of the acceleration of the point charge with distance from its centre?

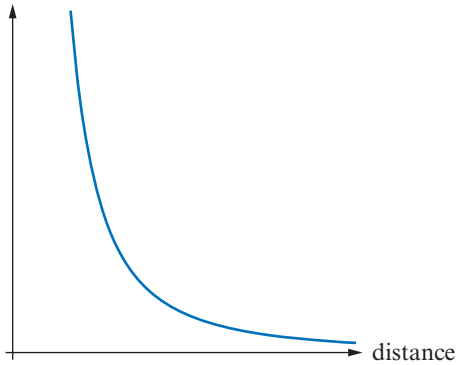
A



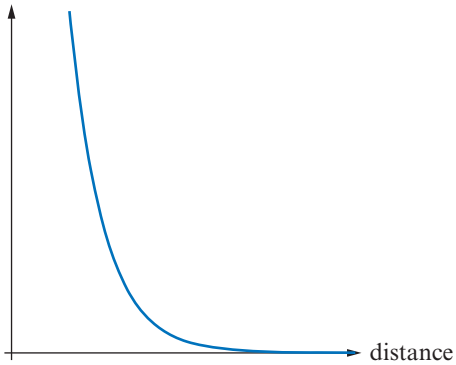
B



C

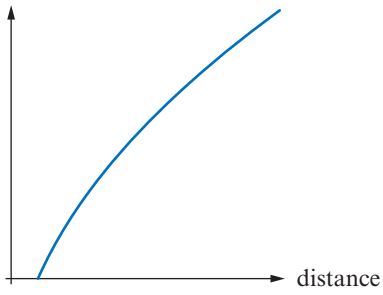


D

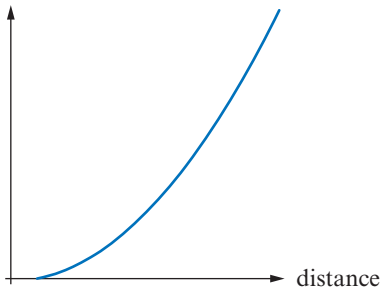


86 A positive point charge is released from rest on the surface of a positively charged sphere. Which graph shows the variation of the speed of the point charge with distance from the centre of the sphere?

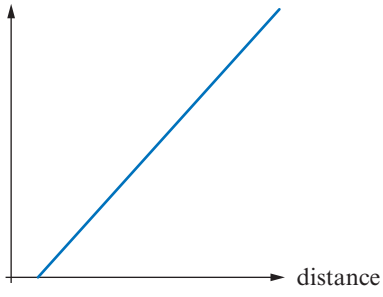
A



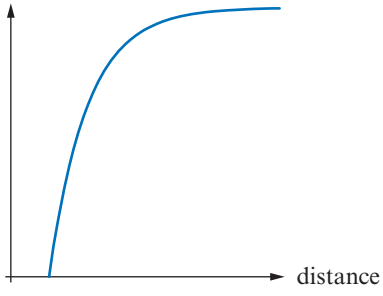
B



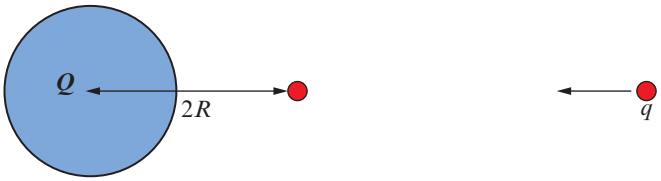
C



D



87 A negative point charge q has kinetic energy E_k when far from a sphere of radius R. The sphere has a negative charge Q. The point charge is directed towards the sphere and is brought to rest at a distance $2R$ from the centre of the sphere.



What is the kinetic energy E_k of point charge q?

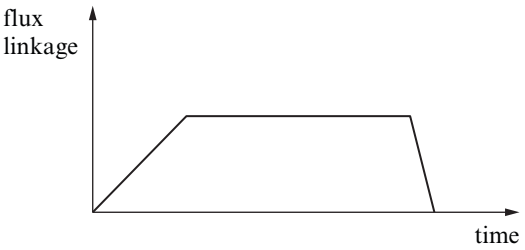
A $E_k = \frac{kQq}{R^2}$

B $E_k = \frac{kQq}{4R^2}$

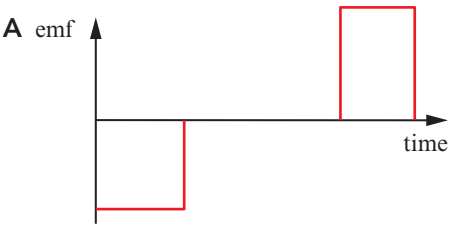
C $E_k = \frac{kQq}{R}$

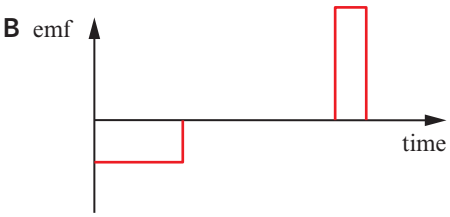
D $E_k = \frac{kQq}{2R}$

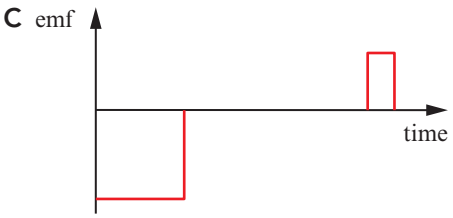
88 The graph shows the variation with time of the magnetic flux linkage in a loop.

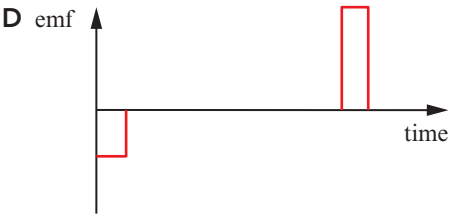


Which graph shows the variation with time of the induced emf in the loop?

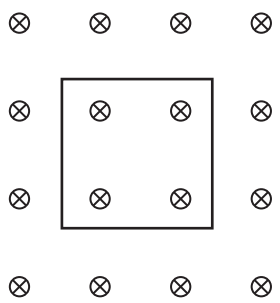
A


B


C


D


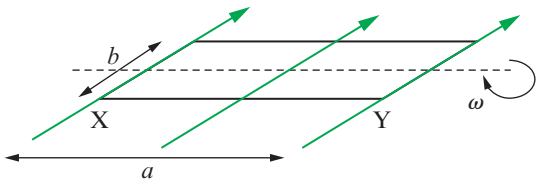
89 A square loop of area 0.20 m^2 has 50 turns of wire around it. The loop is at right angles to a uniform magnetic field. The magnetic flux density is increasing at a rate of 0.04 T s^{-1}.



What is the induced emf in the loop?

A 8.0 mV
B 400 mV
C 5.0 V
D 250 V

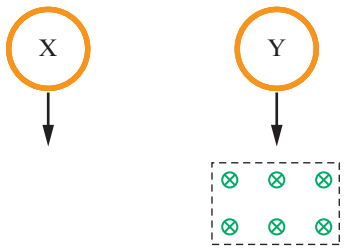
90 A loop of dimensions $a \times b$ rotates in a magnetic field of magnetic flux density H with angular speed ω about the axis shown.



What is the induced emf between X and Y at the instant shown?

A $H\omega a$b
B $\frac{H\omega ab}{2}$
C $H\omega a^2$
D $H\omega b^2$

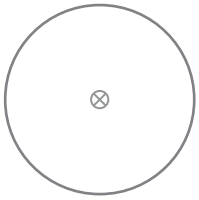
91 Two identical conducting rings, X and Y, are dropped at the same time from the same height above the ground. Ring Y passes through a horizontal magnetic field.



Which ring reaches the ground first?

	Which arrives first	Reasoning
A	X	Y is decelerated by the magnetic field
B	Y	Y is accelerated by the magnetic field
C	X and Y take the same time	Y is decelerated as it enters the field and accelerated as it leaves so average speed is the same as X
D	X and Y take the same time	Y is accelerated as it enters the field and decelerated as it leaves so average speed is the same as X

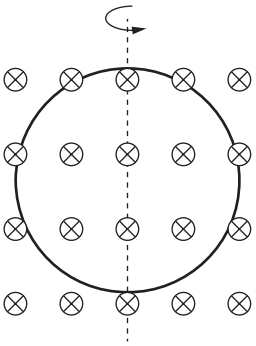
92 A magnetic field of uniformly increasing magnitude is directed into the plane of the page as shown. A conducting loop of wire is on the plane of the page.



Which is correct about the direction and magnitude of the induced current in the wire?

	Direction	Magnitude
A	Clockwise	Constant
B	Anticlockwise	Varying
C	Clockwise	Varying
D	Anticlockwise	Constant

93 A conducting loop of area S is rotated by 360° about the axis shown in a time T. The magnetic flux density is H.



What is the average emf induced in the loop during the time T?

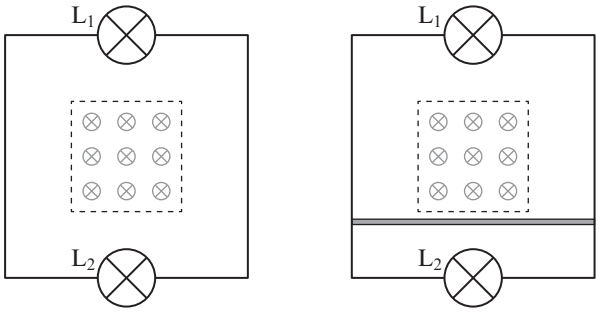
A zero

B $\frac{HS}{T}$

C $\frac{2HS}{T}$

D $\frac{4HS}{T}$

94 A loop of wire contains two identical light bulbs, L_1 and L_2. The region in the loop within the dotted line contains a changing magnetic field whose direction is normal to the plane of the page. Both light bulbs are lit. A copper wire of negligible resistance is placed across the loop as shown in the diagram.



What will be the effect of this wire on the brightness of the light bulbs?

	L_1	L_2
A	Goes out	Gets dimmer
B	Goes out	Gets brighter
C	Gets brighter	Goes out
D	Gets dimmer	Goes out

95 A loop of wire of area S finds itself in a magnetic field directed at right angles to the plane of the loop. The magnetic flux density is M and increases by ΔM in time Δt. The induced current in the loop depends on all of the following **except** one. Which one?

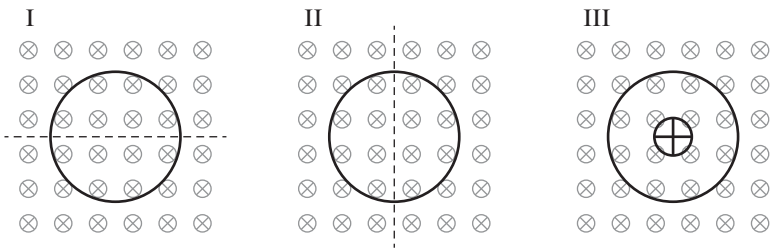
A S

B M

C ΔM

D Δt

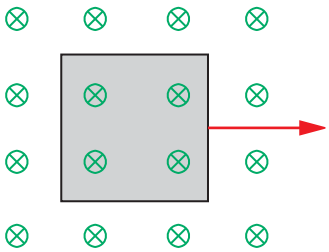
96 A conducting loop of wire is in a region of magnetic field directed into the plane of the page. The loop is rotated about axes I, II and III.



In which case or cases will there be an induced current in the loop?

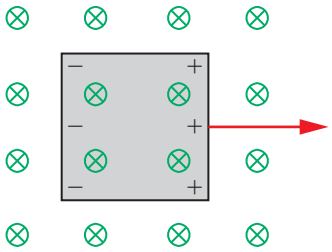
A I and II
B I and III
C II and III
D I, II and III.

97 A metal sheet is moved at constant speed in a magnetic field directed into the page.

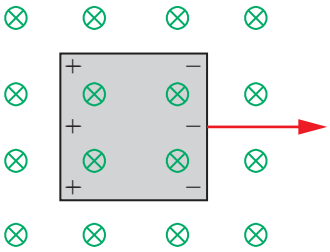


Which diagram shows the correct charge separation in the metal sheet?

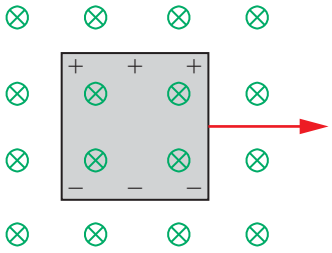
A



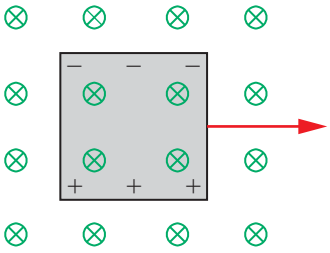
B



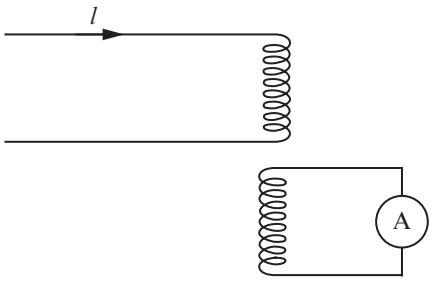
C



D



98 A coil carries current *I*. The coil is placed close to a second coil as shown.



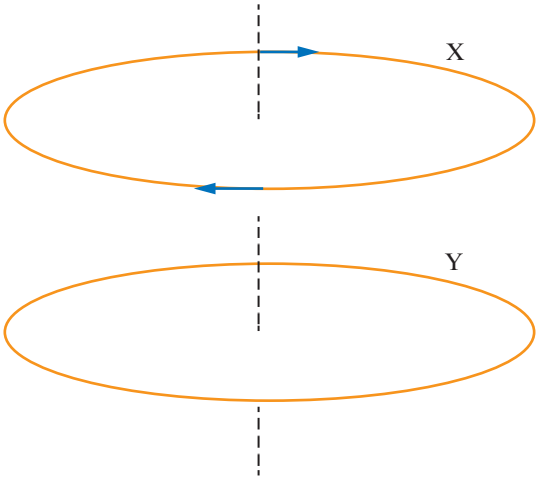
Three states of the current are considered:

I Current is constant.
II Current is increasing.
III Current is decreasing.

For which states of the current is a current registered in the ammeter?

A I and II
B I and III
C II and III
D I, II and III.

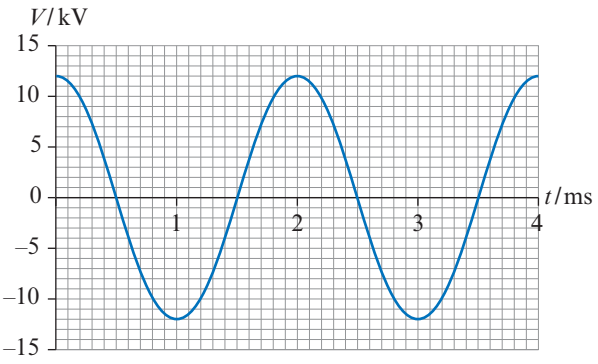
99 Two horizontal parallel loops of wire, X and Y, have a common axis as shown.

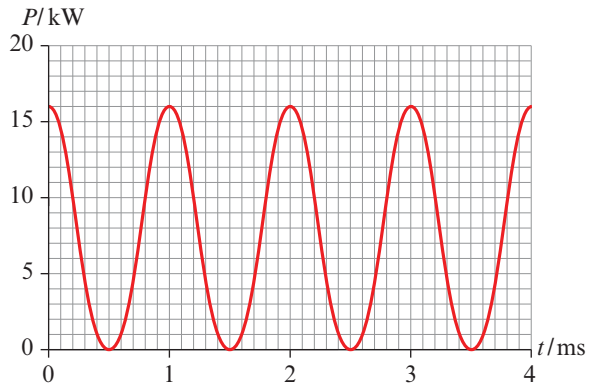


Loop X has a current that is clockwise when viewed from above. The current is decreasing.
What is correct about the induced current in loop Y and the force between X and Y?

	Current in Y	Force
A	Clockwise	Attractive
B	Clockwise	Repulsive
C	Anticlockwise	Attractive
D	Anticlockwise	Repulsive

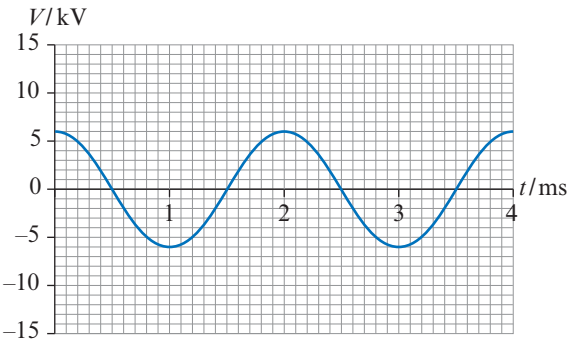
100 A coil is rotated in a magnetic field. An external resistor is connected to the coil. The graphs show the variation with time of the voltage across the resistor and the power dissipated in the resistor.

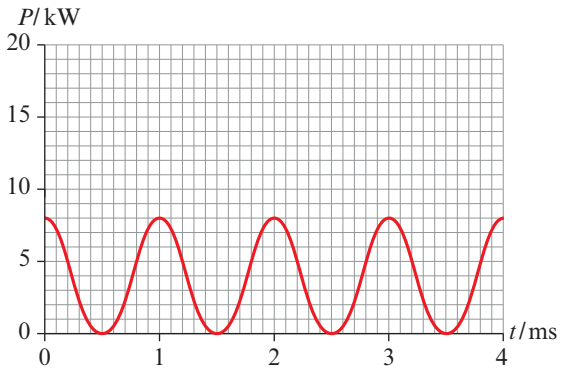




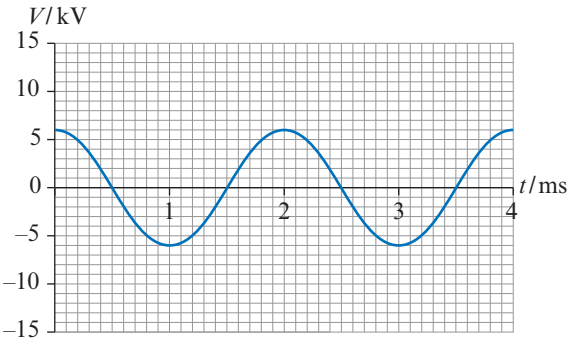
The frequency of rotation is halved. Which graphs show the correct variation with time of the voltage and the power for the same resistor?

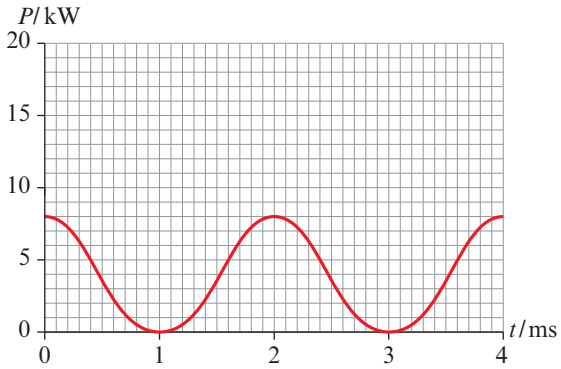
A



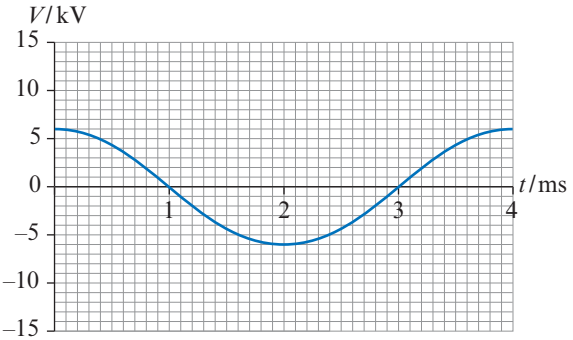


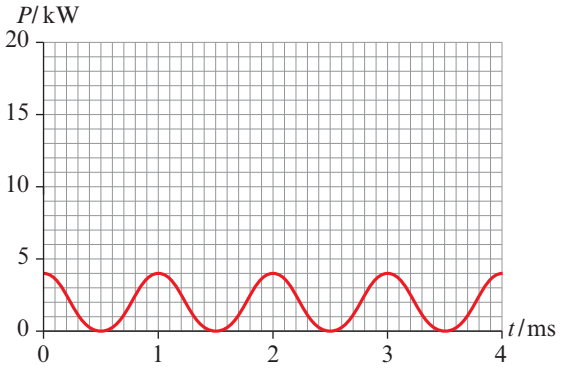
B





C





D