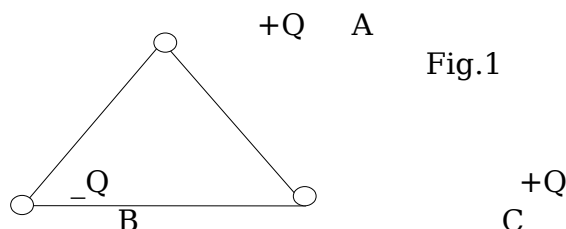
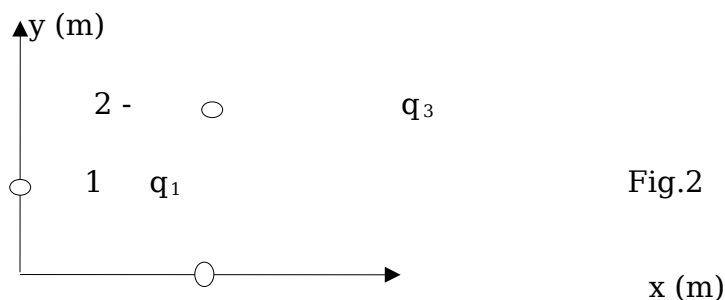


PHYSICS WORK SHEET FOR GRADE 12 STUDENTS IN 2015E.C

- Two charges of equal magnitudes kept at a distance r exert a force of F on each other. If the charges are halved and distance between them is doubled, the new force acting on each charge is:
 A. $F/8$ B. $F/4$ C. $4F$ D. $F/16$
- Three point charges $4q$, Q and q are in straight line in the position of 0 , $l/2$, and l respectively. The resultant force on q will be zero if $Q=?$ A. $-q$
 B. $-2q$ C. $q/2$ D. $4q$
- Three charges are placed at the vertices of an equilateral triangle of side a as shown in fig.1 below. The force experienced by the charge placed at the vertex of A in direction normal to BC is: A. $\frac{Q^2}{4\pi\epsilon a^2}$ B. $\frac{\sqrt{2}Q^2}{4\pi\epsilon a^2}$
 C. $\frac{Q^2}{2\pi\epsilon a^2}$ D. Zero



- Two point charges $+4q$ and $+q$ are kept at a distance of 30cm from each other. At what point b/n them the field intensity will be zero?
 A. 150cm away from the $+4q$ charge. C. 7.5cm away from the $+q$ charge.
 B. 20cm away from the $+4q$ charge. D. 5cm away from the $+q$ charge.
- Two charges, one twice as large as the other, are located 15cm apart and experience a repulsive force of 95N . What is the magnitude of the larger charge?
- In fig.2 shown, take $q_1=68\mu\text{C}$, $q_2=-34\mu\text{C}$, and $q_3=15\mu\text{C}$. Find the electric force on q_3 .



7. In fig. 3 shown, point P is the mid way b/n the two c the electric field in the plane of the page a, 5cm directly above P, b, 5cm directly to the right of P, and c, at P

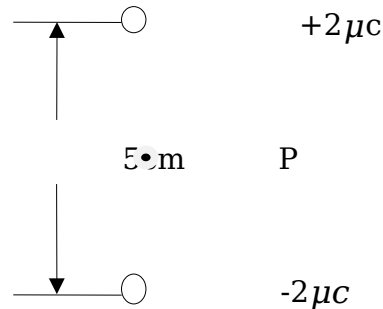
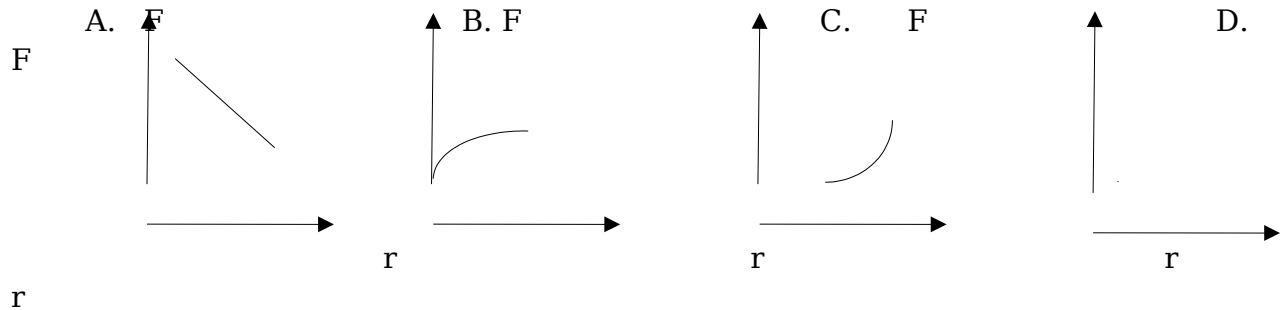


Fig.3

8. Which of the following graphs shows the variation of the force when the distance r between two charges varies?



8. What is the ratio of electrostatic repulsion and gravitational attraction between two electrons?
(Given, $m_e = 9.1 \times 10^{-31}$, $G = 6.67 \times 10^{-11}$, $q_e = 1.6 \times 10^{-16}$)
A. 3.23×10^{42} B. 4.17×10^{42} C. 2.33×10^{42}
D. 1.6×10^{42}
9. Two point charges of $3nC$ and $-2nC$ are spaced $2m$ apart. What is the electric field at a point which is $1m$ from each of the two charges? A. $11V/m$ B. $45V/m$ C. $9V/m$ D. $6V/m$
10. Cathode rays travelling from east to west enter into region of electric field directed towards north to south in the plane of the paper. The deflection of cathode rays is towards:
A. East B. west C. north D. south
11. Three charges $2q$, $-q$, and $-q$ are located at the vertices of an equilateral triangle. At the center of triangle:
A. The field is zero but potential is non zero. C. both field and potential are zero.
B. The field is non zero but potential is zero. D. both field and potential are non zero

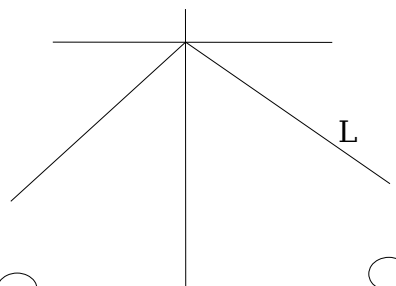
12. If an electron is brought towards another electron, then the electric potential energy of the system will: A. decrease B. increase C. become zero D. remain constant
13. Three point charges $+q$, $+2q$ and Q are placed at the vertices of equilateral triangle. Find the value of charge Q in terms of q , so that the electric potential energy of the system is zero.
14. Two charges of equal magnitude are separated by some distance. If the charges are increased by 10%, to get the same force b/n them, their separation must be:
A. Increased by 21% C. decreased by 10%
B. Increased by 10% D. none of the above
15. Two charges $+4\mu\text{C}$ and $-16\mu\text{C}$ are separated from each other by a distance of 0.6m. At what distance should a third charge of $+6\mu\text{C}$ be placed so that the net force exerted on it will be zero?
A. 0.4m B. 0.6m C. 1.2m D. 0.3m
16. What is the capacitance of a capacitor, if 10^{12} electrons are transferred from one plate to another plate of a capacitor and p.d of 10v develops b/n the two plates?
A. $1.6 \times 10^{-7}\text{F}$ B. $160 \times 10^{-8}\text{F}$ C. $16 \times 10^{-8}\text{F}$ D. $1.6 \times 10^{-8}\text{F}$

17. Two small spheres with the same mass m and charge q are suspended from mass less strings of length L , as shown in fig.5 below. Each string makes an angle of θ with the vertical. Show that the charge on each sphere is:

$$q = \pm 2L \sin \theta \sqrt{\frac{mg \tan \theta}{k}}$$

L

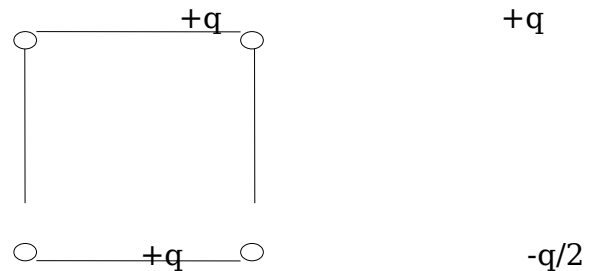
Fig.5



18. Three charges lie in the x-y plane; $q_1 = 55\mu\text{C}$ at $x=0$, $y=2\text{m}$; q_2 at $x=3\text{m}$, $y=0$; and q_3 at $x=4\text{m}$, $y=3\text{m}$. If the force on q_3 is $(8\mathbf{i} + 15\mathbf{j})\text{N}$, find q_2 and q_3 .
19. A $-1\mu\text{C}$ charge experiences a $10\mathbf{i}\text{-N}$ electric force in a certain electric field. What force would a proton experience in the same field?
20. A dipole lies on the y-axis and consists of an electron at $y=0.6\text{mm}$ and a proton at $y=-0.6\text{mm}$. Find the electric field: a, at the midway b/n the two charges b, at the point at $x=2\text{mm}$, and at $x=-2\text{mm}$.
21. Based on question number 21, calculate the electric potentials at these points.
22. A proton accelerates from rest in a uniform electric field of 640N/C . At some later time, its speed is $1.2 \times 10^6\text{m/s}$. a, Find the acceleration of the proton. b, How long does it take the proton to reach this time. c, How far does it moved in this time?

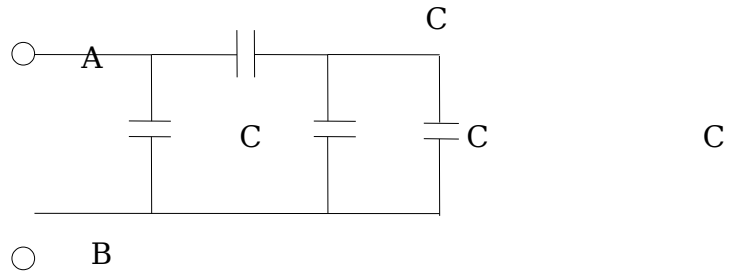
23. A flat surface with area 2m^2 is in a uniform electric field of 850N/C . What is the electric flux through the surface when it is a, at right angles to the field? b, at 45° to the field? and c, parallel to the field?
24. A flat surface with area 0.4m^2 lies in the x-y plane, in a uniform electric field given by $\mathbf{E}=(5\mathbf{i}+2\mathbf{j}+3\mathbf{k})\text{KN/C}$. Find the flux through this surface.
25. Three point charges each carrying $+q$ and a fourth carrying $-q/2$ are initially infinitely far apart. They are brought together to form the square charge distribution shown in fig. 6 below. What is electrostatic potential energy of the charge distribution?

Fig.6



26. What is the equivalent capacitance of the four identical capacitors shown in the fig. 7 below measured b/n A and B?

Fig.7



27. Find the potentials at points A and B if $q_1 = +3\mu\text{C}$, $q_2 = -6\mu\text{C}$ and $q_3 = -9\mu\text{C}$. (See fig. 8 below). What is the electric potential difference b/n point A and B?

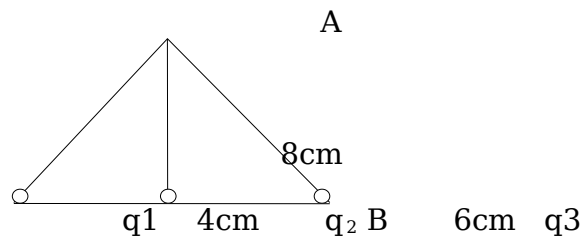


Fig.8

28. Which of the following is correct about the property of equipotential lines?
- A. The electric field is always parallel to the potential lines.
 - B. An equipotential lines having variable potential.
 - C. The electric field is always perpendicular to the potential lines.
 - D. None of the above

29. Four point charges $-Q$, $-q$, $2q$ and $2Q$ are placed, one at each corner of the square. The relation b/n Q and q for which the potential at the center of the square is zero is:

- A. Q/q B. $Q = -q$ C. $-Q/q$ D. $Q=q$

30. A parallel plate capacitor is connected with terminals of a battery. The distance b/n the plates is 6mm. If a glass of plate (dielectric constant $k=9$) 4.5mm is introduced b/n them, then the capacity will be become:

- A. 2times B. the same C. 3times D. 4times

31. Which of the following statements is false for a charged conductor?

- A. The electric field inside the conductor is zero.
 B. The surface of the conductor is an equipotential surface.
 C. The charge carried by the conductor is always uniformly distributed over the surface of the conductor.
 D. The electric field just outside the surface of a conductor is perpendicular to the surface.
 E. All of the above

32. For which of the following parameter variation, the capacitance of the capacitor remains unaffected?

- A. Distance b/n the plates. C. Thickness of the plates.
 B. Area of the plates. D. Nature of dielectric

33. In fig.9 shown, each capacitor has $c=2\mu\text{C}$ and $V_{ab}=40.4\text{V}$. Calculate:

- a, the c_{eq} . b, the charge on each capacitor c, the p.d across each capacitor and d, the p.d b/n the plates a and d.

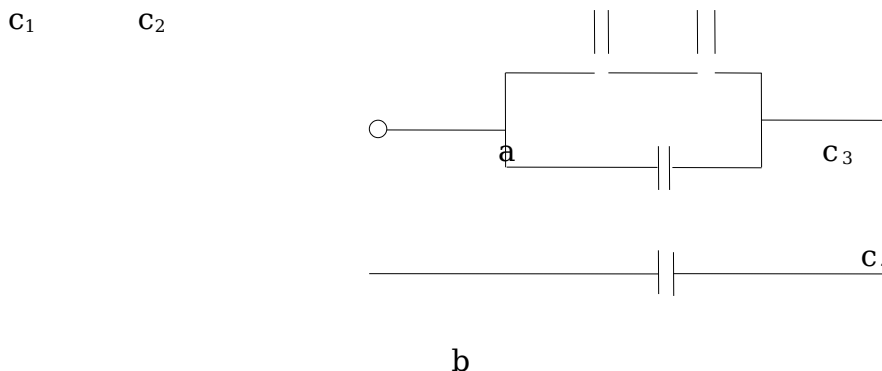


Fig.9

d

34. An air-filled parallel plate capacitor has a capacitance of $3.2\mu\text{F}$. The plate separation is doubled and a dielectric is inserted to completely fill the region b/n the plates. If the new capacitance is 8pF . What is the dielectric constant?

35. Three capacitors each of the capacity c are given. The resultant capacity $2c/3$ can be obtained by combining them:

- A. All in series B. all in parallel C. two in parallel and 3rd in series D. two in series and 3rd in parallel

36. Three point charges q_1 , q_2 and q_3 lie at the corners of an equilateral triangle of side 10cm. The force between them are $F_{12}=54\text{N}$ (attractive), $F_{13}=15\text{N}$

(repulsive), and $F_{23}=9\text{N}$ (attractive). Given that q_1 is negative, what are q_2 and q_3 ?

37. Two point charges are located on the x-axis, $q_1 = -e$ at $x=0$ and $q_2 = +e$ at $x=a$. a, Find the work that must be done by an external force to bring a third charge $q_3 = +e$ from infinity to $x=2a$.

b, Find the total potential energy of the system of the three charges.

38. The capacitance of a parallel plate capacitor is C . If a dielectric slab of thickness equal to one-fourth of the plate separation and dielectric constant

k is inserted b/n the plates, then the new capacitance become: A. $\frac{kC}{2(k+1)}$

B. $\frac{2kC}{k+1}$ C. $\frac{5kC}{4k+1}$ D. $\frac{4kC}{3k+1}$

39. What happens to the energy stored in a capacitor, if the plates of a charged capacitor are drawn apart, the battery remaining connected?

A. Decrease B. Increase C. Becomes constant D. Zero

40. Three point charges $q+Q$, q , and $q-Q$ are enclosed by the surface s . What is the net flux that crosses s ? A. $\frac{3q}{\epsilon}$ B. $\frac{2q}{\epsilon}$ C. $\frac{3q-Q}{\epsilon}$

D. none

41. If the distance b/n parallel plates of a capacitor is halved and dielectric constant is doubled then the capacitance will become:

A. half B. two times C. four times D. remain constant

42. Consider the net work given in fig.10. Calculate the electric potential energy stored in each capacitor. Given that the capacitance of each capacitor $c=1\mu\text{F}$.

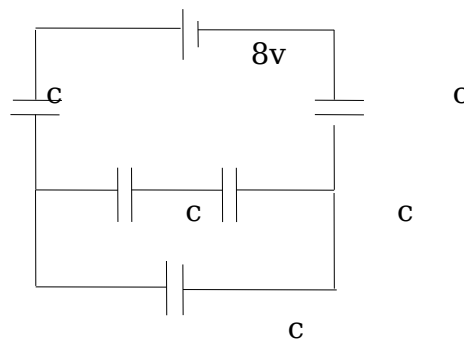


Fig.10

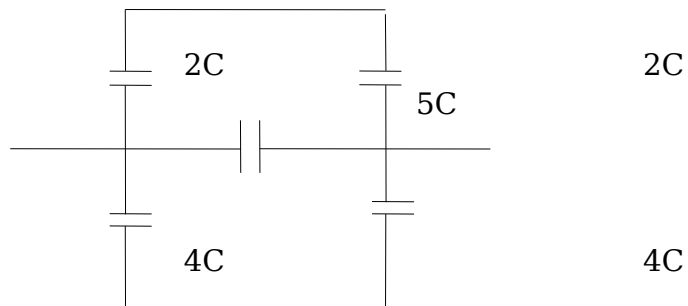
43. A capacitor has some dielectric between the plates, and the capacitor is connected to a dc source. The battery is now disconnected and the dielectric is removed then :

A. capacitance will increase C. electric field will increase
B. energy stored will decrease. D. voltage will decrease

44. When an electric dipole is placed in a uniform electric field E , then:

- A. The torque on the dipole is $\mathbf{P} \times \mathbf{E}$
 B. C. the dipole moment is directed towards positive charge
 C. The resultant force on dipole is zero. D. all of the above
45. "The total electric flux through any closed surface surrounding charges is equal to the amount of charge enclosed". This statement is associated with:
 A. Coulomb's law B. Gauss's law
46. A capacitor having capacitance of $5\mu\text{F}$ is charged to a p.d of 10^4V . The energy stored in the capacitor is: A. 50J B. 150J C. 200J D. 250J
47. What is the value of capacitance that must be connected in parallel with 50pF capacitor to make an equivalent capacitance of 150pF ? A. 50pF B. 100pF C. 150pF D. 200pF
48. The type of capacitors used in communication transmitters are:
 A. Electrolytic capacitors B. variable capacitors C. Air capacitors D. Glass capacitors
49. The work done in carrying a charge Q once round a circle of radius r with charge q at the center of the circle is: A. $\frac{Qq}{4\pi\epsilon r}$ B. $\frac{Qq}{2r}$ C. $\frac{Q}{4\pi\epsilon qr}$ D. Zero
50. The electric field at a point on equatorial line of a dipole and direction of dipole moment:
 A. Will be parallel C. will be in opposite direction
 B. Will be perpendicular D. are not related
51. The capacity of a parallel plate capacitor is $10\mu\text{F}$ when the distance b/n its plates is 9cm . What will be its capacity if the distance between the plates is reduced by 6cm ?
52. Four point charges $1, -2, -3$, and $4\mu\text{C}$ are located on the x-axis at $x=1, 2, 3$ and 4m respectively. How much energy is stored in the field?
53. The equivalent capacitance of the combination shown in fig.11 below is:
 A. 7F B. 5F C. 6F D. 8F

Fig.11



54. Look at the diagram given in fig.12 below; determine the sign of the charge of the suspended ball.

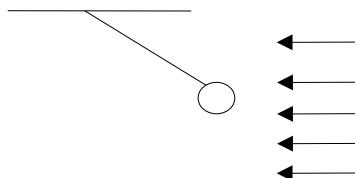


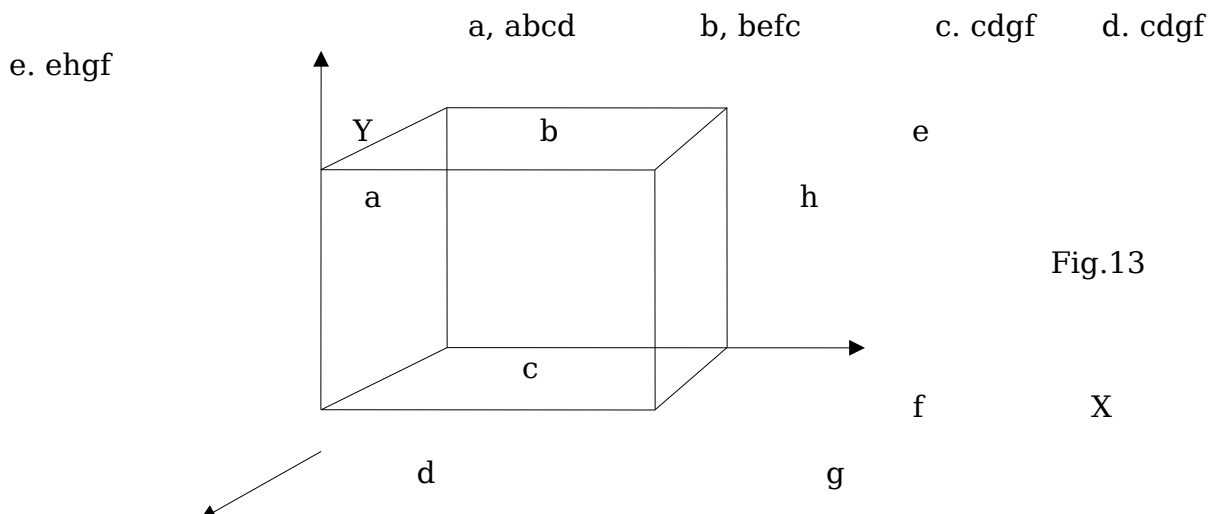
Fig.12

E

55. Two capacitors C_1 and C_2 are in series, with the voltage V across the combination. Show that the voltages across the individual capacitors are:

$$V_1 = \frac{C_2 V}{C_1 + C_2} \quad \text{and} \quad V_2 = \frac{C_1 V}{C_1 + C_2}$$

56. If a third charge equal and similar charge is placed b/n two equal and similar charges, then this third charge will:
- Move out of the field of influence of the charges.
 - Remain in equilibrium.
 - move towards the right
 - move towards the left
57. The Earth has an electric field of about 150 N/C pointed down ward. A 1 m radius water droplet is suspended in calm air. Find (a) the mass of water droplet, (b) the charge on the water droplet and (c) the number of excess electrons on the droplet
58. An electron ($q_e = -e$, $m_e = 9.1 \times 10^{-31} \text{ kg}$) is projected out along $+x$ -axis with an initial speed of $3 \times 10^6 \text{ m/s}$. It goes 45 cm and stops due to an electric field in the region. Find the magnitude and direction of the field.
59. Small object carrying a charge of -5 nc experiences a down ward force of $20 \times 10^{-9} \text{ N}$ when placed at a certain point in an electric field. What is the magnitude and direction of the electric field at the point?
60. A cube of side 20 cm is placed in a region where there is 5 N/C electric field along the direction $+x$ -direction as shown in fig.13 below. Find the electric flux through each of the following surfaces.



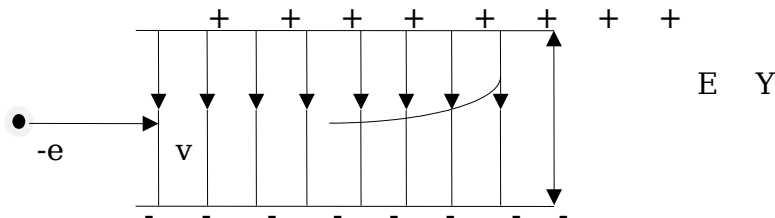
Z

61. Consider point charges $+q$ at $x=a$ and $+q$ at $x=-a$. Show that the point at any point along the x -axis is given by: $V=k \frac{2q}{\sqrt{x^2+y^2}}$

62. A particle of mass m and charge $-e$ is projected with horizontal speed v into an electric field E , directed downward as shown in fig.14 below. What is the vertical displacement Y of the particle after time t ? A. $\frac{eEt}{m}$ B. vt

C. $\frac{eEt^2}{2m}$

D. $\frac{2eEt}{m}$



63. Charged capacitor is connected across a $10k\Omega$ resistor and allowed to discharge. The p.d across the capacitor to 0.368 of its original value after a time of 7s. What is the capacitance of the capacitor?

64. A $10\mu F$ capacitor is charged by 10v battery through a resistor R . The capacitor reaches a potential difference of 4v in a period of 3s after the charging began. Find the value of R .

PHYSICS WORK SHEET-2 FOR GRADE 12 STUDENTS

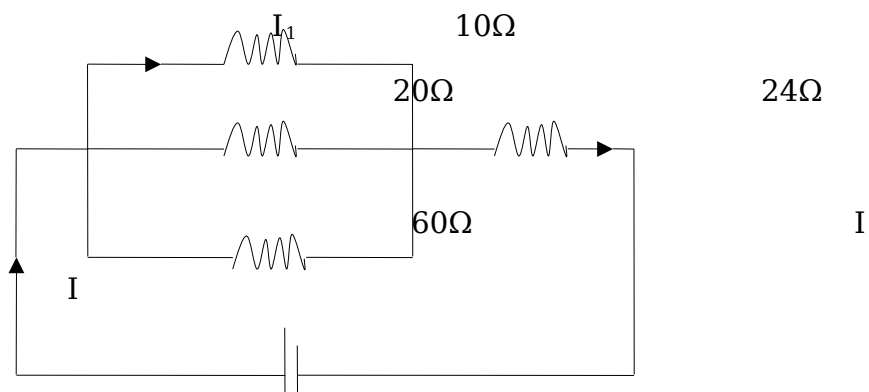
65. The substances which have a large number of free electrons and offer a low resistance are called

- A. Insulators B. Inductors C. Conductors D. Semi-conductors

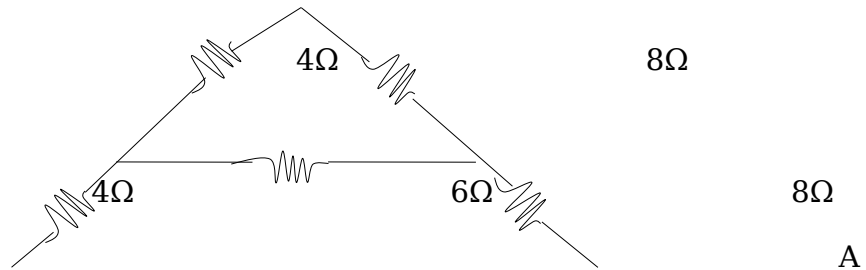
66. Two copper conductors have equal length. The cross-sectional area of one of the conductor is four times that of the other. If the conductor having

- smaller cross-sectional area has a resistance of 40Ω , then the resistance of the other conductor will be: A. 160Ω B. 80Ω C. 20Ω D. 10Ω
67. Which of the following statements is true for both series and parallel dc circuit?
- A. Currents are additive
B. Voltages are additive
C. Powers are additive
D. Elements have individual currents
68. For a given voltage, four heating coils will produce maximum heat, when connected:
- A. all in parallel
B. all in series
C. one pair in parallel with the other two in series
D. with no parallel pairs in series
69. The charge in a capacitor is given by $q = (v + \frac{1}{3} v^3)$. If the voltage across this capacitor be $v(t) = \sin t$, the current $I(t)$ through the capacitor is:
- A. $(1 + \sin 2t) \cos t$
B. $(1 + \sin 2t) \sin t$
C. $(1 + \cos 2t) \sin t$
D. $\sin 2t \cos t$
70. The resistance of a parallel circuit consisting of two branches is 12Ω . If the resistance of one branch is 18Ω , what is the resistance of the other? A. 18Ω B. 36Ω C. 48Ω D. 64Ω
71. Four wires having the same resistance, when connected in parallel give a resistance of 0.25Ω . If these wires are connected in series the effective resistance will be: A. 1Ω B. 2Ω C. 3Ω D. 4Ω
72. Which one of the following statement is true?
- A. A galvanometer with low resistance in parallel is voltmeter.
B. A galvanometer with high resistance in parallel is voltmeter.
C. A galvanometer with low resistance in series is ammeter.
D. A galvanometer with low resistance in high is ammeter.
73. The resistance of a copper wire 200m long is 21Ω . If its thickness (diameter) is 0.44mm , its specific resistivity is around: A. $1.2 \times 10^{-8} \Omega \cdot \text{m}$ B. $1.4 \times 10^{-8} \Omega \cdot \text{m}$ C. $1.6 \times 10^{-8} \Omega \cdot \text{m}$ D. $1.8 \times 10^{-8} \Omega \cdot \text{m}$

74. In the circuit shown, the ratio of the current I_1 to current I (I_1/I) is
- A. $1/5$ B. $2/5$ C. $5/3$ D. $4/5$



74. Three resistors of equal resistance R are connected in series and then connected in parallel. What will be the ratio of equivalent resistance in series and parallel?
 A. 1:9 B. 1:3 C. 3:1 D. 9:1
75. Two electrical resistances R and $2R$ are connected in parallel combination. This combination is connected in series with a battery of potential difference v . What is the ratio of heat dissipated in two resistances? A. 2:1 B. 4:1 C. 1:4 D. 8:1
76. The equivalent resistance b/n A and B for the network shown below is:
 A. 7.2Ω B. 16Ω C. 30Ω D. 4.8Ω



77. The wire of resistance ' R ' is cut into ' m ' equal parts. These parts are then connected in parallel with each other. The effective resistance of the combination is:
 A. $\frac{R}{m^2}$ B. $\frac{m^2}{R}$ C. mR D. not attempted
78. A cell of negligible resistance and emf $2V$ is connected to in series with 2Ω , 3Ω and 5Ω resistors. The p.d in volts b/n the terminals of 3Ω resistor will be: A. 0.6 B. $\frac{2}{3}$ C. 3 D. 6
79. Four wires of equal length and of resistances 10Ω each are connected in the form of a square. The equivalent resistance b/n two opposite corners of the square will be:
 A. 10Ω B. 40Ω C. 20Ω D. $\frac{10}{4}\Omega$
80. Two resistors are connected first in series and then in parallel. The equivalent resistance in the two cases are 9Ω and 2Ω respectively. The resistances of the component resistors are:
 A. 2 and 7 B. 3 and 6 C. 3 and 9 D. 5 and 4
81. Resistors of 1, 2, 3Ω are connected in the form of triangle. If a $1.5v$ cell of negligible internal resistance is connected across 3Ω resistor, the current flowing through this will be:
 A. $0.25A$ B. $0.5A$ C. $1A$ D. $1.5A$

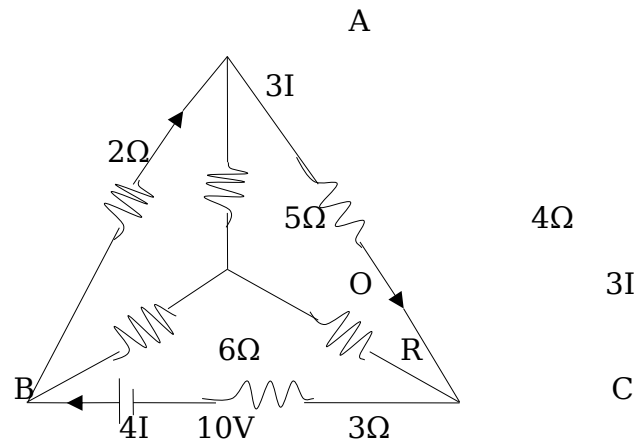
82. Which one of the following is correct about the power consumed by R_1 and R_2 connected in series if the value of R_1 is greater R_2 ?

- A. R_1 will consume more power
 B. R_2 will consume more power
 C. R_1 and R_2 will consume the same power
 D. All

83. Which one of the following will happen in transformer when the number of secondary turns less than the number of primary turns?

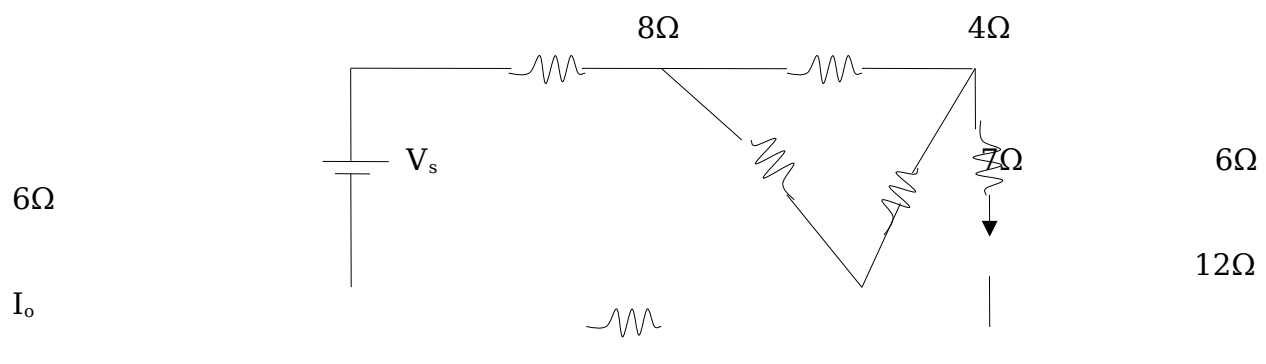
- A. The voltage stepped up
 B. The voltage stepped down
 C. The power gets stepped up
 D. The power stepped down

84. In the circuit shown in the following fig. what is the value of the unknown resistance R when the current in the branch OA is zero?
 A. 5Ω
 B. 3Ω
 C. 12Ω
 D. 10Ω



85. For the network shown in the following fig. below, the value of V_s which makes $I_o = 7.5\text{mA}$ is

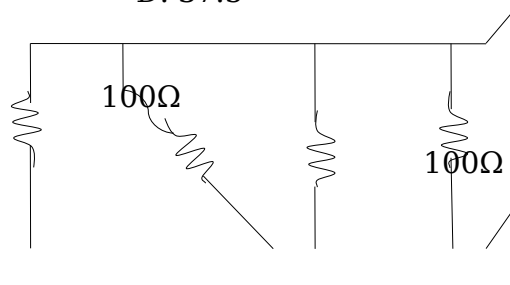
- A. 725mV
 B. 680mV
 C. 695mV
 D. 705mV



86. What is the total resistance (in ohms) of the following circuit?

- A. 22.5 B. 27.5 C. 32.5 D. 37.5

100Ω 100Ω

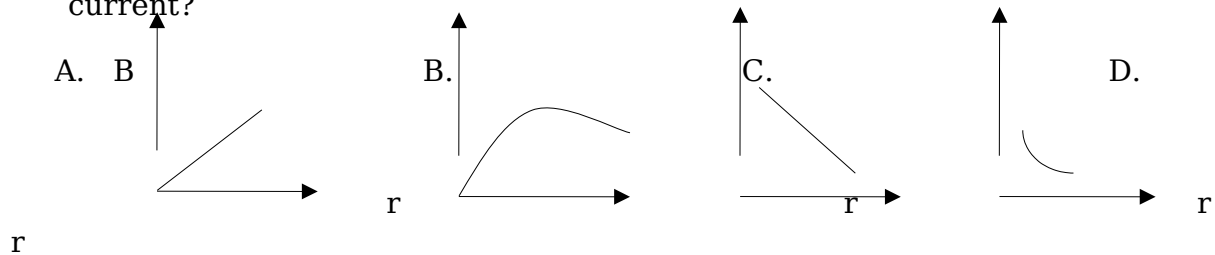


87. The north pole of a magnet is brought near a stationary negatively charged conductor. What is the force experienced by it at the poles?
 A. Maximum B. Minimum C. Zero D. Depend on the nature of the conductor
88. A conductor of length l has current I passing through it. When it is placed parallel to a magnetic field, the force experienced by the conductor will be:
 A. Zero B. Bli C. $2Bli$ D. $Bli/2$
89. Which of the following statements is true about magnetic lines of force?
 The magnetic lines of force:
 A. are always closed C. tend crowd far away from the poles of the magnet
 B. are intersecting each other D. do not pass through the vacuum
90. A particle of charge e and mass m moves with a velocity v in a magnetic field B applied perpendicular to the motion of the particle. The radius of its path in the field is:
 A. $\frac{mv}{Be}$ B. $\frac{Be}{mv}$ C. $\frac{ev}{Bm}$ D. $\frac{Bv}{me}$
91. What will be the direction of a magnetic field B if an alpha particle projected towards the north is deflected towards east by a magnetic field?
 A. Towards south B. Upwards C. Towards east D. Downwards
92. A positively charged particle is moving vertically upwards. When it enters a region of magnetic field directed towards north, what is the direction of the force on the charge?
 A. Up B. Down C. Left D. Right
93. An electron and proton enter a magnetic field with equal velocities, which one of them experiences more force?
 A. Proton C. Both experience the same force

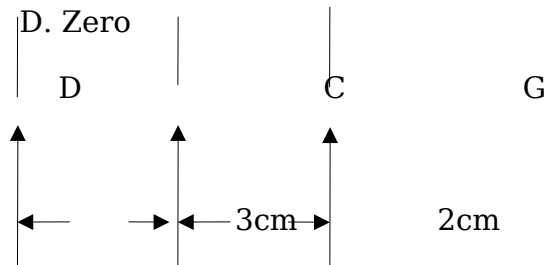
- B. Electron D. It cannot be predicted
94. A charged particle of mass m and charge q travels on a circular path of radius r that is perpendicular to a magnetic field B . The time taken by the particle to complete one revolution is:
- A. $\frac{2\pi m}{qB}$ B. $\frac{2\pi qB}{m}$
 C. $\frac{2\pi m q}{B}$ D. $\frac{2\pi q^2 B}{m}$
95. A galvanometer having a coil resistance of 60Ω shows full scale deflection when a current of $1A$ passes through it. It can be converted into ammeter to read a current up to $5A$ by:
- A. Putting in series a resistance of 15Ω . C. Putting in series a resistance of 240Ω .
 B. Putting in parallel a resistance of 15Ω . D. Putting in parallel a resistance of 240Ω .
96. A charged particle after being accelerated through a potential difference V enters in a uniform magnetic field B and moves in a circle of radius r . If V is doubled, then the radius of the circle will be:
- A. $2r$ B. $\sqrt{2}r$
 C. $4r$ D. $\frac{1}{\sqrt{2}r}$
97. A charged particle is moving on circular path with velocity v in a uniform magnetic field B , if the velocity of the charged particle is doubled and strength of magnetic field is halved, then radius becomes:
- A. 8times B. 4times
 C. 2times D. 16times
98. A proton enters in magnetic field of flux density $5T$ with a velocity of $5 \times 10^7 m/s$ at an angle of 30° with the field. What is the force on the proton?
- A. $0.2 \times 10^{-11}N$ B. $2 \times 10^{-11}N$ C. $20 \times 10^{-11}N$ D. $200 \times 10^{-11}N$
100. A electron having a charge q moves with a velocity v x-direction. An electric field acts on the Y- direction. The force on the electron acts in:
- A. positive direction of Y-axis C. negative direction of Y-axis
 B. positive direction of Z-axis D. negative direction of Z-axis
101. If a charged particle moves through a magnetic field perpendicular to it, then
- A. both momentum and energy of the particle change.

- B. momentum as well as energy are constant.
- C. energy is constant but momentum changes
- D. momentum is constant but energy changes.

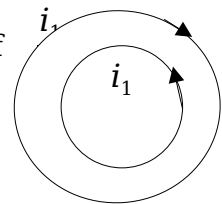
102. Which one of the following graphs correctly represents the variation of magnetic field induction with distance r due to a thin wire carrying current?



103. Three long, straight parallel wires carrying current are arranged as shown in fig. below. The force experienced by 25cm, length of the wire C is: A. 10^{-3}N
B. $2.5 \times 10^{-3}\text{N}$ C. $1.5 \times 10^{-3}\text{N}$ D. Zero

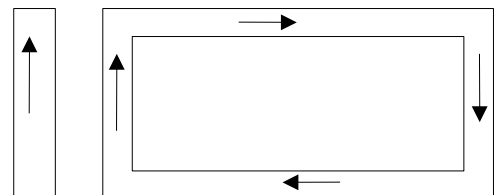


104. A and B are two concentric circular loops carrying currents i_1 and i_2 as shown in the fig. below. If the ratio of the radii is 1:2 and ratio of magnetic flux densities at the center o due to A and B is 1:3 then the value of i_2/i_1 is: A. $1/2$ B. $1/3$ C. $1/4$ D. $1/6$

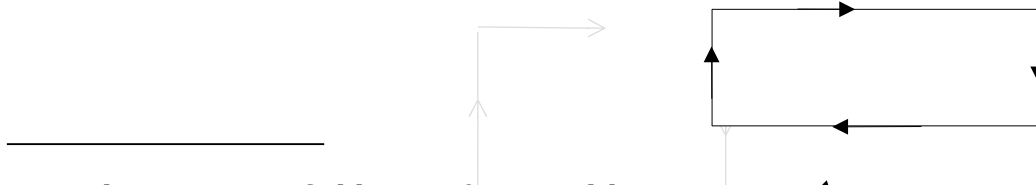


105. A rectangular loop carrying a current I is situated near a long straight wire such that the wire is parallel to one of the sides of the loop and is in the plane of the loop. If the steady current I is established in the wire as shown in fig. the loop will:

- A. rotate about an axis parallel to the wire.
- B. move away the wire or toward the right.
- C. move towards the wire.
- D. remain stationary.



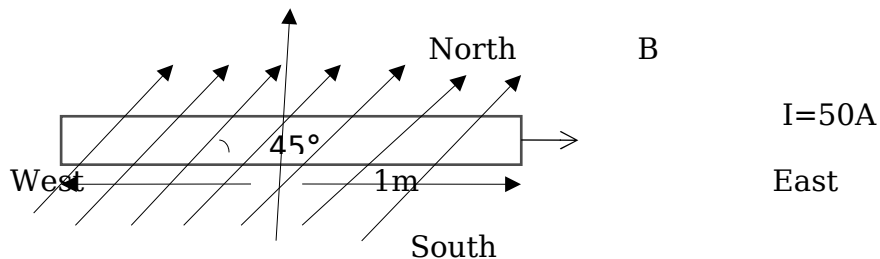
106. The current in a wire decreases with time according to the relation $I=2.5e^{-at}$. Determine the total charge that has flowed through the wire by the time the current has diminished to zero.
107. Conductor in a shape of the square of edge length $l=0.4\text{cm}$ carries a current $I=10\text{A}$ as shown in the fig. below. Calculate the magnitude and direction of the magnetic field produced at the centre of the square.



108. The magnetic field is uniform and has components: $B_x=0.107\text{T}$, $B_y= -1.13\text{T}$, and $B_z= 0.538\text{T}$. A wire 0.15m long lies along the y-axis and carries a current of 8A in $+y$ -direction.
- (a) Find the components of the force on the wire.
- (b) What is the magnitude of the total force on the wire?

109. Straight horizontal copper rod carries a current of 50A , from west to east in a region between the poles of a large electromagnet. In this region there is a horizontal magnetic field toward the north east that is 45° north of east, with magnitude 1.2T , as shown in fig. below.

Find the magnitude and direction of force on 1m section of rod.



110. A copper wire has a square cross-section 1.8mm on a side. The wire is 5m long and carries a current of 4.6A . The density of the free electrons is $8.5 \times 10^{28}/\text{m}^3$.

- a. What is the current density in the wire b. What is the electric field?
- C. How much time is required to an electron to travel the length of the wire?

111. The current in a wire varies with time according to the relation:

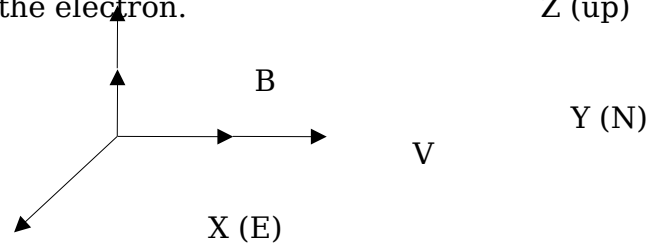
$$3\text{A} + 0.73\text{t}^2\text{A/s}^2.$$

- a. How many coulomb's of the charge pass a cross section of the wire in the time interval between $t=0$ and $t=10\text{s}$?
- b. What constant current would transport the same charge in the same time interval?

112. Two long, parallel wires are separated by a distance of 5cm. The force per unit length that each wire exerts on the other is $6 \times 10^{-5} \text{N/m}$, and the wires repel each other. The current in one wire is 2A.

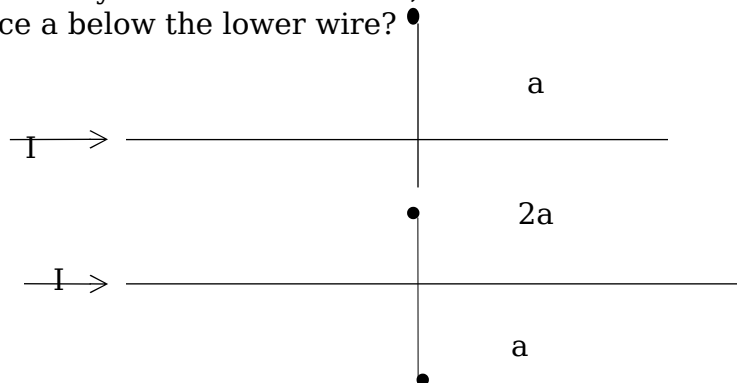
- What is the current in the second wire?
- Are the two currents in the same or opposite directions?

113. A 2keV electron is fired northward into a uniform upward 0.1T magnetic field as shown in fig. below. Find the force on the electron.



114. Two long, straight wire one above the other, are separated by a distance $2a$ and are along the x-axis. Let the +y-axis in the plane of the wires is the direction from the lower wire to the upper wire. Each wire carries current I in +x-direction. What are the magnitude and direction of the net field of the two wires at appoint in the plane of the wires.

- mid-way between them?
- at a distance a above the upper wire?
- at a distance a below the lower wire?

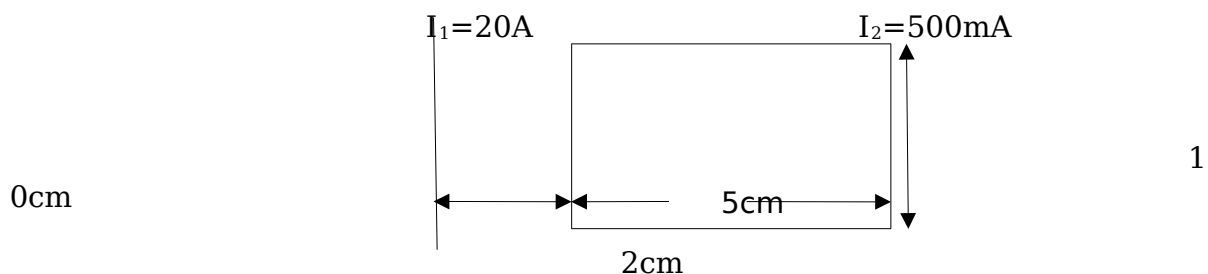


115. Two long parallel wires are separated by a distance 5cm. The force per unit length that each wire exerts on the other is $6 \times 10^{-5} \text{N/m}$, and the wires repel each other. The current in one wire is 2A.

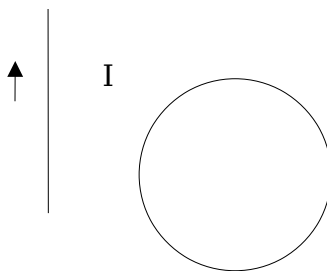
- What is the current in the second wire?
- Are the two currents in the same or opposite directions?

115. A wire carries a steady current of 3A. A straight section of the wire, with the length of 50cm placed along the x-axis, lies with a uniform magnetic field $\mathbf{B} = (2\mathbf{i} + 3\mathbf{k}) \text{ T}$. If the current flows in the +x-direction, what is the magnetic force on the section of the wire?

116. Two long parallel wires, a distance d apart, carry currents I and $3I$ in the same direction. Locate the point(s) at which their magnetic field vanishes.
117. A long straight wire carries 20A . A 5cm by 10cm rectangular wire loop carrying 500mA is located 2cm from the wire, as shown in fig. below. Find the net force on the loop.



118. A circular conducting wire lies next to a long -straight wire carrying current I in the direction indicated in fig. below. In which direction is the induced current in the loop?



119. Two coils have a mutual inductance of 2H . If current in the first coil is changing at a rate of 60A/s , what is the emf in the second coil?
120. Two coils have a mutual inductance of 580mH . One coil is supplied with the current given by:
- $I = 3t^2 - 2t + 4$** , where I is in amperes and t is in seconds. What is the induced emf in the other coil at $t = 2.5\text{s}$?
121. An alternative current given by **$I_0 \sin 2\pi ft$** is supplied to one of the two coils whose mutual inductance is M . a, Find an expression for the emf in the second coil b, When $I_0 = 1\text{A}$, and $f = 60\text{Hz}$, the peak emf (V_0) in the second coil is measured at 50V . What is the mutual inductance?
122. The current in a 2H inductor is given by **$I = 3t^2 + 15t + 8$** , where t is in seconds and I in amperes. Find the expression for the magnitude of induced emf.
123. Two coils have mutual inductance M . The current supplied to coil A is given **$I = bt^2$** . Find the expression for the magnitude of the induced emf in coil B.

124. Coil A and B have mutual inductance 25mH . At time $t=0$, the current in coil A is zero. Subsequently at time varying current to A, and the induced emf in coil B is given by $\varepsilon=50+0.2t$, with ε in v and t in s. Find an expression for the time-varying current in coil A.
125. An RLC series circuit contains a 20Ω resistor, a 180mH inductor and a $60\mu\text{F}$ capacitor connected to a 110V-rms 60Hz power supply. Find the rms current and voltage for each element.