केंद्रीय विद्यालय संगठन क्षेत्रीय कार्यालय रायपुर

Kendriya Vidyalaya Sangathan Regional Office Raipur

Class - XII

Multiple Choice Question Bank [MCQ] Term – I

PHYSICS [042]

Based on Latest CBSE Exam Pattern for the Session 2021-22

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MESSAGE FROM DUPUTY COMMISSIONER

It is a matter of great pleasure for me to publish study material for different subjects of classes X and XII for Raipur Region. Getting acquainted and familiarized with the recent changes in curriculum and assessment process made by CBSE vide Circular No. 51 and 53 issued in the month of July 2021 will help students to prepare themselves better for the examination. Sound and deeper knowledge of the Units and Chapters is must for grasping the concepts, understanding the questions. Study materials help in making suitable and effective notes for quick revision just before the examination.

Due to the unprecedented circumstances of COVID-19 pandemic the students and the teachers are getting very limited opportunity to interact face to face in the classes. In such a situation the supervised and especially prepared value points will help the students to develop their understanding and analytical skills together. The students will be benefitted immensely after going through the question bank and practice papers. The study materials will build a special bond and act as connecting link between the teachers and the students as both can undertake a guided and experiential learning simultaneously. It will help the students develop the habit of exploring and analyzing the ***Creative & Critical Thinking Skills***. The new concepts introduced in the question pattern related to case study, reasoning and ascertain will empower the students to take independent decision on different situational problems. The different study materials are designed in such a manner to help the students in their self-learning pace. It emphasizes the great pedagogical dictum that *'everything can be learnt but nothing can be taught'*. The self-motivated learning as well as supervised classes will together help them achieve the new academic heights.

I would like to extend my sincere gratitude to all the principals and the teachers who have relentlessly striven for completion of the project of preparing study materials for all the subjects. Their enormous contribution in making this project successful is praiseworthy.

Happy learning and best of luck!

Vinod Kumar
(Deputy Commissioner)

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Kendriya Vidyalaya Sangathan Regional Office Raipur

Our Patorn

Vinod Kumar
Deputy Commissioner
KVS RO Raipur

Smt.Biraja Mishra
Assistant Commissioner
KVS RO Raipur

Sh.A.K. Mishra
Assistant Commissioner
KVS RO Raipur

Shri Bhoop Singh
Principal, Kendriya Vidyalaya Kanker

CONTENT TEAM

NAME OF UNIT	NAME OF PGT PHYSICS
Chapter 1 - Electric Charges and Field Chapter 2 – Electrostatic Potential and Capacitance	**Mrs. Surita Saini** **KV Rajnandgoan**
Chapter 3 - Current Electricity	**Mr. Y K Tiwari** **KV Durg**
Chapter 4 - Moving Charges and Magnetism Chapter 5 - Magnetism and Matter	**Mr. Raju Gupta** **KV Ambikapur**
Chapter 6 - Electromagnetic Induction Chapter 7 - Alternating Current	**Mr. H S Tripathi** **KV Mahasamund**
Sample Paper 1	**Mr N D Sahu** **KV Kanker**
Sample Paper 2	**Mrs. Archana Khare** **KV NTPC Korba**
Sample Paper 3	**Mr. B R Gajpal** **KV No.1 Shift 1 Raipur**
Review Committee	**Mrs. Sunita Khirbat** **KV BMY Bhilai** **Mr. Somen Dasgupta** **KV Bilaspur**

Term- 1

		MARKS
UNIT-1	**ELECTROSTATICS**	17
	Electric Charges and Fields	
	Chapter–2: Electrostatic Potential and Capacitance	
UNIT-2	**CURRENT ELECTRICITY**	
	Chapter–3: Current Electricity	
UNIT-3	**Magnetic Effects of Current and Magnetism**	18
	Chapter–4: Moving Charges and Magnetism	
	Chapter–5: Magnetism and Matter	
UNIT-4	**Electromagnetic Induction and Alternating Currents**	
	Chapter–6: Electromagnetic Induction	
	Chapter–7: Alternating Current	
		35

Term wise syllabus 2021-22 with deleted part

CLASS-XII

SUBJECT-PHYSICS

SYLLABUS	DELETED PART
Electrostatics 23 Periods **Chapter–1: Electric Charges and Fields** Electric Charges; Conservation of charge, Coulomb's law-force between two-point charges, forces between multiple charges; superposition principle and continuous charge distribution. Electric field, electric field due to a point charge, electric field lines, electric dipole, electric field due to a dipole, torque on a dipole in uniform electric field. Electric flux, statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet **Chapter–2: Electrostatic Potential and Capacitance** Electric potential, potential difference, electric potential due to a point charge, a dipole and system of charges; equipotential surfaces, electrical potential energy of a system of two point charges and of electric dipole in an electrostatic field. Conductors and insulators, free charges and bound charges inside a conductor. Dielectrics and electric polarization, capacitors and capacitance, combination of capacitors in series and in parallel, capacitance of a parallel plate capacitor with and without dielectric medium between the plates, energy stored in a capacitor.	**Chapter-1 Electric charges and fields** Uniformly charged thin spherical shell (field inside and outside).
Unit II: Current Electricity 15 Periods **Chapter–3: Current Electricity** Electric current, flow of electric charges in a metallic conductor, drift velocity, mobility and their relation with electric current; Ohm's law, electrical resistance, V-I characteristics (linear and non-linear), electrical energy and power, electrical resistivity and conductivity; Temperature dependence of resistance. Internal resistance of a cell, potential difference and emf of a cell, combination of cells in series and in parallel, Kirchhoff's laws and simple applications, Wheatstone bridge, metre bridge(qualitative ideas only). Potentiometer - principle and its applications to measure	**Chapter-3 Current Electricity** Carbon resistors, colour code for carbon resistors; series and parallel combinations of resistors

potential difference and for comparing EMF of two cells; measurement of internal resistance of a cell (qualitative ideas only)	
Unit III: Magnetic Effects of Current and Magnetism 16 Periods **Chapter–4: Moving Charges and Magnetism** Concept of magnetic field, Oersted's experiment. Biot - Savart law and its application to current carrying circular loop. Ampere's law and its applications to infinitely long straight wire. Straight and toroidal solenoids (only qualitative treatment), force on a moving charge in uniform magnetic and electric fields. Force on a current-carrying conductor in a uniform magnetic field, force between two parallel current-carrying conductors- definition of ampere, torque experienced by a current loop in uniform magnetic field; moving coil galvanometer-its current sensitivity and conversion to ammeter and voltmeter. **Chapter–5: Magnetism and Matter** Current loop as a magnetic dipole and its magnetic dipole moment, magnetic dipole moment of a revolving electron, bar magnet as an equivalent solenoid, magnetic field lines; earth's magnetic field and magnetic elements.	**Chapter-4 Moving Charges and Magnetism** Cyclotron **Chapter-5 Magnetism and Matter** Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis, torque on a magnetic dipole (bar magnet) in a uniform magnetic field; Para-, dia- and ferro - magnetic substances, with examples. Electromagnets and factors affecting their strengths, permanent magnets.
Unit IV: Electromagnetic Induction and Alternating Currents 19 Periods **Chapter–6: Electromagnetic Induction** Electromagnetic induction; Faraday's laws, induced EMF and current; Lenz's Law, Eddy currents. Self and mutual induction. **Chapter–7: Alternating Current** Alternating currents, peak and RMS value of alternating current/voltage; reactance and impedance; LC oscillations (qualitative treatment only), LCR series circuit, resonance; power in AC circuits. AC generator and transformer.	**Chapter-7 Alternating Current** Power factor, wattless current.

Syllabus assigned for Practical

Term I Total Periods:16

First & Second term practical examination will be organized by schools as per the directions of CBSE and viva will be taken by both internal and external observers (IN Term-II Only by external only).

The record to be submitted by the students at the time of first term examination has to include a record of at least 4 Experiments and 3 Activities to be demonstrated by teacher.

Evaluation Scheme

Time Allowed: one and half hours Max.: **Marks: 15**

- Two experiments to be performed by students at time of examination - 8 Marks
- Practical record [experiments and activities] - 2 Marks
- Viva on experiments, and activities - 5 marks
- **TOTAL MARKS -15**

Experiments assigned for Term I

1. To determine resistivity of two / three wires by plotting a graph between potential difference versus current.
2. To find resistance of a given wire /standard resistor using meter bridge.

OR

To verify the laws of combination (series) of resistances using a meter bridge.

OR

To verify the laws of combination (parallel) of resistances using a meter bridge.

3. To compare the EMF of two given primary cells using potentiometer.

OR

To determine the internal resistance of given primary cell using potentiometer.

4. To determine resistance of a galvanometer by half-deflection method and to find its figure of merit.

5. To convert the given galvanometer (of known resistance and figure of merit) into a voltmeter of desired range and to verify the same.

OR

To convert the given galvanometer (of known resistance and figure of merit) into an ammeter of desired range and to verify the same.

6. To find the frequency of AC mains with a sonometer.

A**ctivities assigned for Term I**

1. To measure the resistance and impedance of an inductor with or without iron core.
2. To measure resistance, voltage (AC/DC), current (AC) and check continuity of a given circuit using multimeter.
3. To assemble a household circuit comprising three bulbs, three (on/off) switches, a fuse and a power source.
4. To assemble the components of a given electrical circuit.
5. To study the variation in potential drop with length of a wire for a steady current.

To draw the diagram of a given open circuit comprising at least a battery, resistor/ rheostat, key, ammeter and voltmeter. Mark the components that are not connected in proper order and correct the circuit and also the circuit diagram.

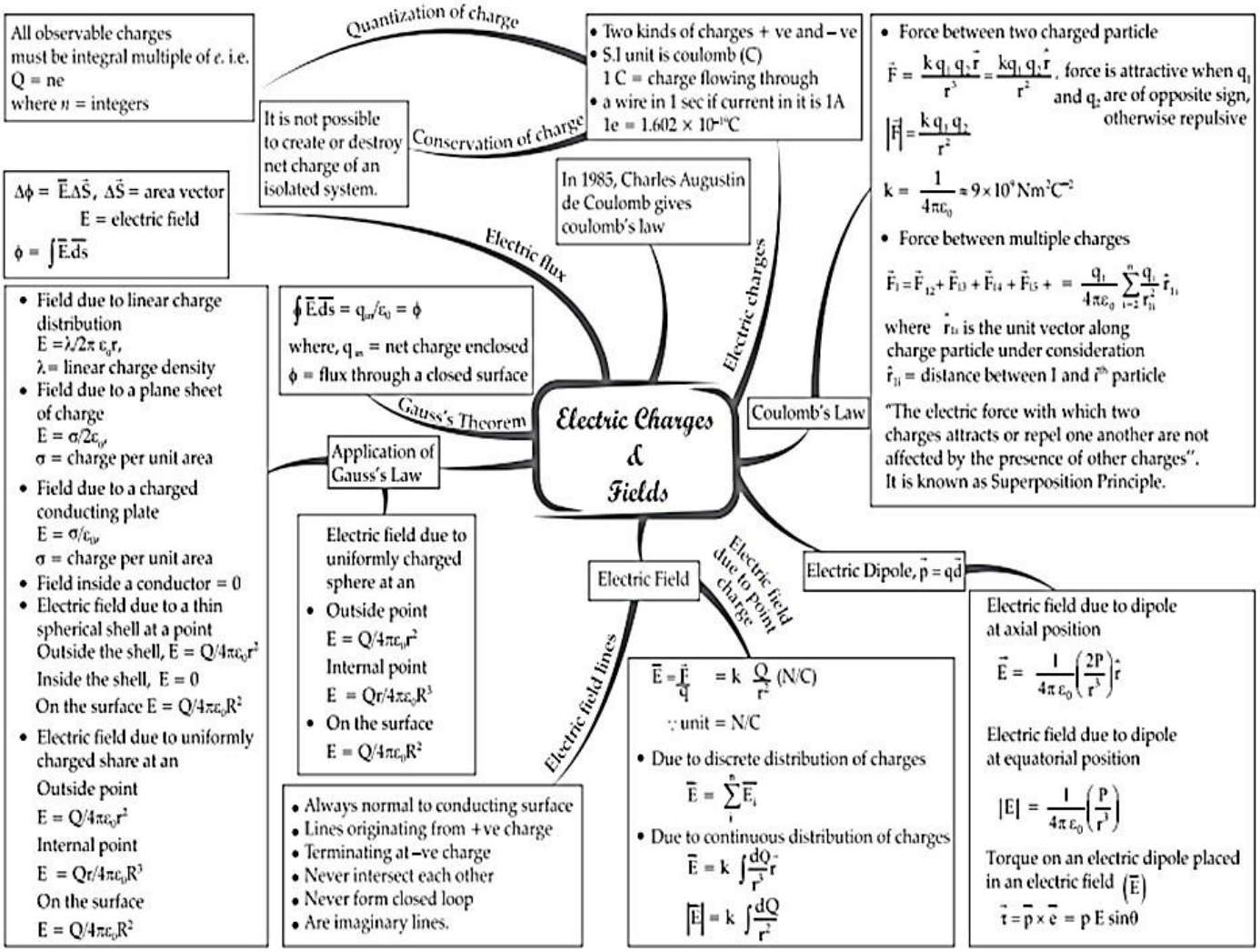
CBSE ACAD CIRCUAR/51/ DATED July 05, 2021

Term I Examinations:

- At the end of the first term, the Board will organize **Term I Examination** in a flexible schedule to be conducted between November-December 2021 with a window period of 4-8 weeks for schools situated in different parts of country and abroad. Dates for conduct of examinations will be notified subsequently.
- The Question Paper will have Multiple Choice Questions (MCQ) including case-based MCQs and MCQs on assertion-reasoning type. Duration of test will be **90 minutes** and it will cover only the rationalized syllabus of **Term I only** (i.e. approx. 50% of the entire syllabus).
- Question Papers will be sent by the CBSE to schools along with marking scheme.
- The exams will be conducted under the supervision of the External Center Superintendents and Observers appointed by CBSE.
- The responses of students will be captured on OMR sheets which, after scanning may be directly uploaded at CBSE portal or alternatively may be evaluated and marks obtained will be uploaded by the school on the very same day. The final direction in this regard will be conveyed to schools by the Examination Unit of the Board.
- Marks of the **Term I** Examination will contribute to the final overall score of students.

CHAPTER 1 - ELECTRIC CHARGES AND FIELD

MIND MAP



MULTIPLE CHOICE QUESTIONS

1. A charge q is placed at the centre of the line joining two exactly equal positive charges Q. The system of these charges will be in equilibrium, if q is equal to

   A. $-\frac{Q}{4}$ B. $-\frac{Q}{2}$ C. $+\frac{Q}{4}$ D. $+\frac{Q}{2}$

2. Electric charges of 1μC, -1 μC and 2μC are placed in air at the corners A,B and C respectively of an equilateral triangle ABC having length of each side 10 cm. The resultant force on the charge at C is

   A. 0.9 N B 1.8 N C 2.7 N D. 3.6 N

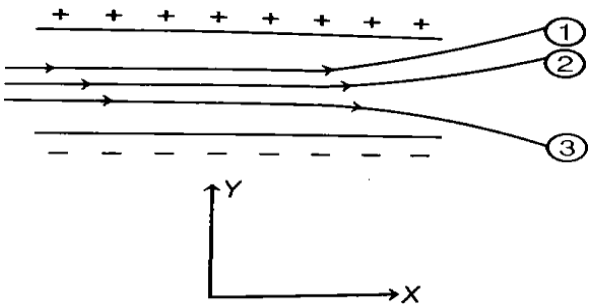
3. When the charge of a body becomes half, the electric field becomes

   A. Half B. Twice C. Thrice D. No change

4. An electron enters uniform electric field maintained by parallel plates and of value 'E' V m^{-1} with a velocity ' v ' ms^{-1}. The plates are separated by a distance 'd' metre. What is the acceleration of the electron in the field

A. $\frac{eE}{m}$ B. $-\frac{eE}{m}$ C. $\frac{Ed}{m}$ D. $\frac{Ed^2}{m}$

5. The given figure shows tracks of three charged particles n a unform electrostatic field. Which particle has the highest charge to mass ratio?



A. 1 B. 2 C. 3 D. All are equal

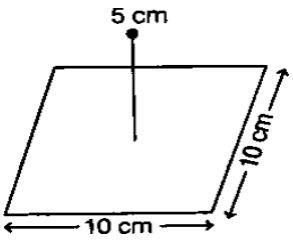
6. What is the nature of gaussian surface involved in Gauss's law of electrostatics?

A. Scalar B Electrical C Magnetic D Vector

7. An electrical dipole is placed in an unform electric field with the dipole axis asking an angle θ with the direction of electrical field. The orientation of the dipole for stable equilibrium is

A. π/6 B. π/3 C. 0 D. π/2

8. A point charge + 10 μC is at a distance 5 cm directly above the centre of a square of side 10 cm, as shown in figure. What is the magnitude of the electric flux through the square?



A. Zero B. 8 x 10^2 Nm^2C^{-1}

C. 1.8 x 10^4 Nm^2 C^{-1} D1.8 x 10^5 Nm C^{-1}

9. Which of the following statements is / are incorrect regarding the point charge?

A. The charge Q on a body is always given by q=ne, where n is any integer, positive or negative.

B. By convention, the charge on an electron is taken to be negative.

C. The fact that electric charge is always an integral multiple of *e* is termed as quantisation of charge

D. The quantisation of charge was experimentally demonstrated by Newton in 1912.

10. Electric field at a point varies as r° for

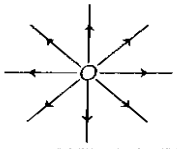
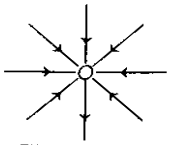
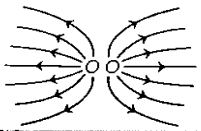
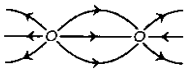
A. Point charge B. Dipole

C. Line charge D. Infinite plane sheet of charge

11. Two spheres have their surface charge densities in the ratio of 2 :3 and their radii 3 :2. The ratio of the charges on them is:

A. 3:2 B. 4:2 C. 2:3 D. 2:4

12. Match the column 1(electrical lines of force) with column 2(type of charge) and select the correct answer from the given codes below

Column I		Column II
A. 	p.	A pair of equal and opposite charges
B. 	q.	A pair of positive charges
C. 	r.	A single positive charge
D. 	s.	A single negative charge

Codes

	A	B	C	D		A	B	C	D
A.	p	q	r	s	B.	r	q	p	s
C	r	s	p	q	D.	r	s	q	p

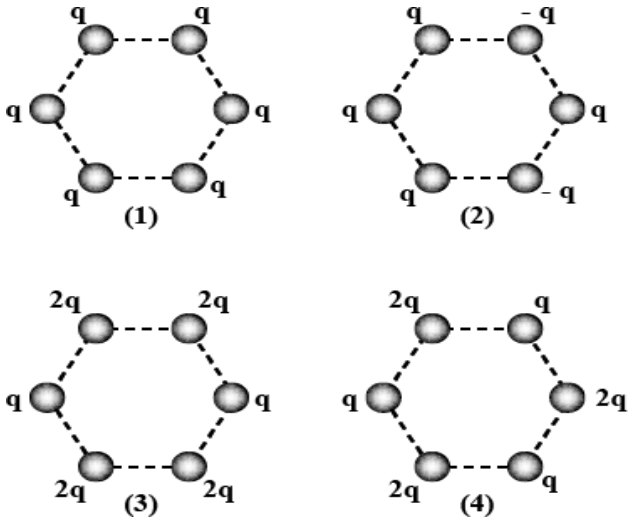
13. Charge on a body is Q_1 and it is used to charge another body by induction. Charge on second body is found to be Q_2 after charging, then

A. $q_1 / q_2 = 1$ B. $q_1 / q_2 < 1$ C. $q_1 / q_2 \leq 1$ D. $q_1 / q_2 \geq 1$

14. The force between 2 charges 0.0 6m apart is 5 N. If each charge is moved towards each other by 0.04 m then the force between them will become

A. 7.20 N B. 11.25 N C. 22.50 N D. 45.00 N

15. Figure below show regular hexagons with charges at the vertices In which case the electric field at the centre zero?



A. 1 B.2 C.3 D.4

ASSERTION AND REASONING QUESTIONS

These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect.

1. Assertion When we produce charge q_1 on a body by rubbing it against another body which gets a charge q_2 in the process then $q_1 + q_2 = 0$

   Reason Charge on an isolated system remains constant.

2. Assertion Electric line of force cross each other

   Reason Electric field at a point does not superimposes to give one resultant electric field.

3. Assertion On going away from a small electric dipole electric field decrease

   Reason electric field is inversely proportional to square of distance from an electric dipole.

4. Assertion The electric flux of the electric field $\oint \mathbf{E}.d\mathbf{A}$ is zero. The electric field is zero everywhere on the surface.

   Reason: The charge inside the surface is zero.

5. Assertion If a point charge be rotated in a circle around a charge, the work will be zero

   Reason Work done is equal to dot product of force and distance.

6. Assertion If a conducting medium is placed between two charges, then electric force between them becomes zero

   Reason Reduction in a force due to introduce material is inversely proportional to dielectric constant.

7. Assertion Charge is quantized

   Reason Charge which is less than 1C is not possible

8. Assertion Excess charge on a conductor resides entirely on the outer surface.

   Reason Like charges repel one another.

9. Assertion When a neutral body is charged negatively, its mass increases slightly.

   Reason When a body is charged negatively, it gains some electrons and electron has finite mass; though quite small

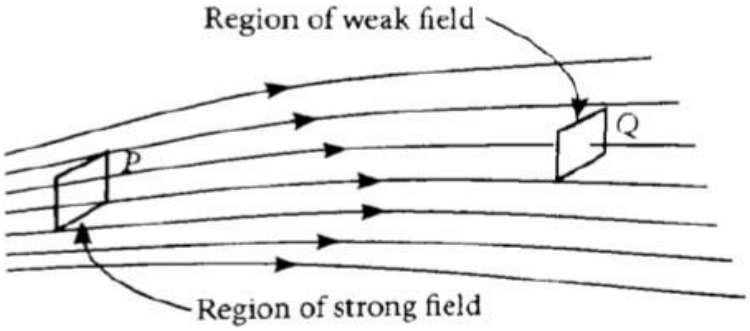
10. Assertion As force is a vector quantity, hence electric field intensity is also a vector quantity.

    Reason The unit of electric field intensity is Newton per coulomb.

CASE STUDY BASED QUESTIONS

RELATIONSHIP BETWEEN STRENGTH OF ELECTRIC FIELD AND DENSITY OF LINE OF FORCES.

Electric field strength is proportional to the density of lines of force i.e., electric field strength at a point is proportional to the number of lines of force cutting a unit area element placed normal to the field at that point. As illustrated in given figure, the electric field at P is stronger than at Q.



1) Electric lines of force about a positive point charge are

   (a) radially outwards (b) circular clockwise

   (c) radially inwards (d) parallel straight lines

2) Which of the following is false for electric lines of force?

   (a) They always start from positive charge and terminate on negative charges.

   (b) They are always perpendicular to the surface of a charged conductor.

   (c) They always form closed loops.

   (d) They are parallel and equally spaced in a region of uniform electric field.

3) Which one of the following patterns of electric line of force is not possible in field due to stationary charges?

4) Electric field lines are curved

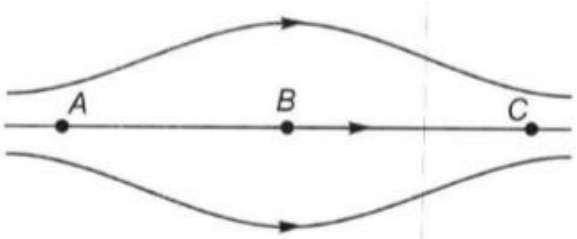
(a) in the field of a single positive or negative charge

(b) in the field of two equal and opposite charges.

(c) in the field of two like charges.

(d) both (b) and (c)

5) The figure below shows the electric field lines due to two positive charges. The magnitudes E_A, E_B and E_C of the electric fields at point A, B and C respectively are related as



(a) $E_A > E_B > E_C$ (b) $E_B > E_A > E_C$ (c) $E_A = E_C > E_B$ (d) $E_A > E_B = E_C$

ANSWERS

S NO	ANS MCQs.	S NO	ANS Assertion / Reasoning
1	A	1	A
2	B	2	D
3	A	3	C
4	B	4	D
5	C	5	A
6	D	6	A
7	C	7	C
8	D	8	B
9	D	9	A
10	D	10	B
11	A	S NO	ANS CASE STUDY
12	D	1	A
13	D	2	C
14	B	3	C
15	B	4	D
		5	C

TEST PAPER

1. When a glass rod is rubbed with silk, it

   (a) gains electrons from silk. (b) gives electrons to silk.

   (c) gains protons from silk. (d) gives protons to silk.

2. The force between two charges is 120N. If the distance between the two charges is doubled, the force will be

   (a) 30N (b) 60N (c) 15N (d) 40N

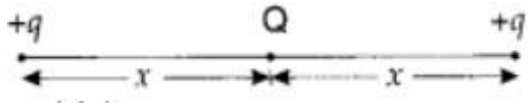
3. Two large metal sheets having surface charge density $+\sigma$ and $-\sigma$ are kept parallel to each other at a small separation distance d. The electric field at any point in the region between the plates is

   (a) σ/ε_0 (b) $\sigma/2\varepsilon_0$ (c) $2\sigma/\varepsilon_0$ (d) $\sigma/4\varepsilon_0$

4. SI unit of permittivity of free space is

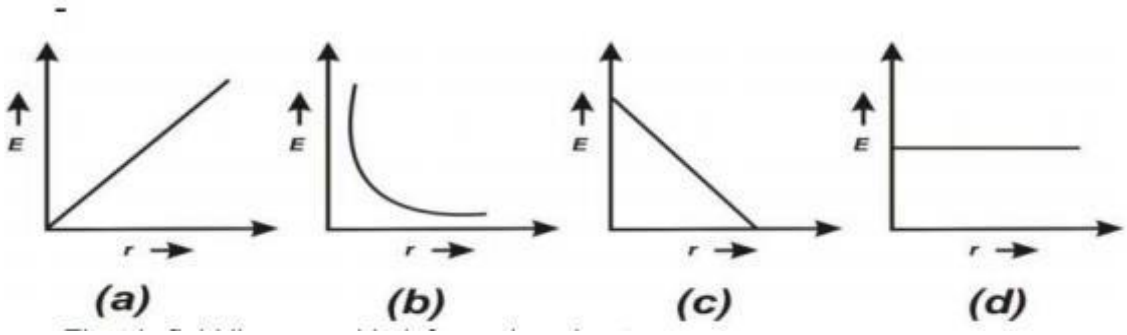
   (a) Farad (b) Weber (c) $C^2N^{-1}m^{-2}$ (d) $C^2N\,m^{-2}$

5. A charge Q is placed at the centre of the line joining two-point charges +q and +q as shown in the figure. The ratio of charges Q and q is



   (a) 4 (b) 1/4 (c) -4 (d) -1/4

6. For a point charge, the graph between electric field versus distance is given by:



7. When an electric dipole is placed in a uniform electric field, it experiences

   a) Force as well as torque b) Torque but no net force

   c) Force but no torque d) Neither any force nor any torque

8. The angle between area of equipotential surface and electric field is-

   (a) 0^0 (b) 90^0

   (c) Between 0^0 and 90^0 (d) Between 90^0 and 180^0

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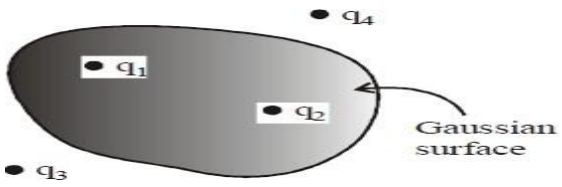
(c) If the Assertion is correct but Reason is incorrect.

(d) If both the Assertion and Reason are incorrect

9. Assertion When a charged body is brought near to an uncharged conducting body equal and opposite charge is induced on the nearer surface of the conducting body.

   Reason Net electric field inside the conductor is zero.

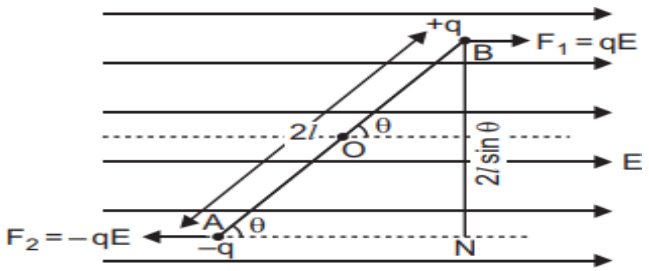
10. Assertion: Four-point charges q1, q2, q3 and q4 are as shown in figure. The flux over the shown Gaussian surface depends only on charges q1 and q2.



   Reason In coulombic attraction two bodies are oppositely charged.

CASE STUDY BASED MCQs

11. When electric dipole is placed in uniform electric field, its two charges experience equal and opposite forces, which cancel each other and hence net force on electric dipole in uniform electric field is zero. However these forces are not collinear, so they give rise to some torque on the dipole. Since net force on electric dipole in uniform electric field is zero, so no work is done in moving the electric dipole in uniform electric field. However, some work is done in rotating the dipole against the torque acting on it.



1. The dipole moment of a dipole in a uniform external field $\bar{E}$ is P. Then the torque τ acting on the dipole is

(a) τ=P x E (b) $\tau = P.\bar{E}$

(c) $\tau = 2(P + \bar{E})$ (d) $\tau = (P + E)$

2. An electric dipole consists of two opposite charges, each of magnitude 1.0 μC separated by a distance of 2.0 cm. The dipole is placed in an external field of 10^5 NC^{-1}. The maximum torque on the dipole is

(a) 0.2×10^{-3} Nm (b) 1×10^{-3} Nm

(c) 2×10^{-3} Nm (d) 4×10^{-3} Nm

3. Torque on a dipole in uniform electric field is minimum when θ is equal to

(a) 0° (b) 90° (c) 180° (d) Both (a) and (c)

4. When an electric dipole is held at an angle in a uniform electric field, the net force F and torque τ on the dipole are

(a) F= 0, $\tau = 0$ (b) $F \neq 0, \tau \neq 0$

(c) $F=0, \tau \neq 0$ (d) $F \neq 0, \tau = 0$

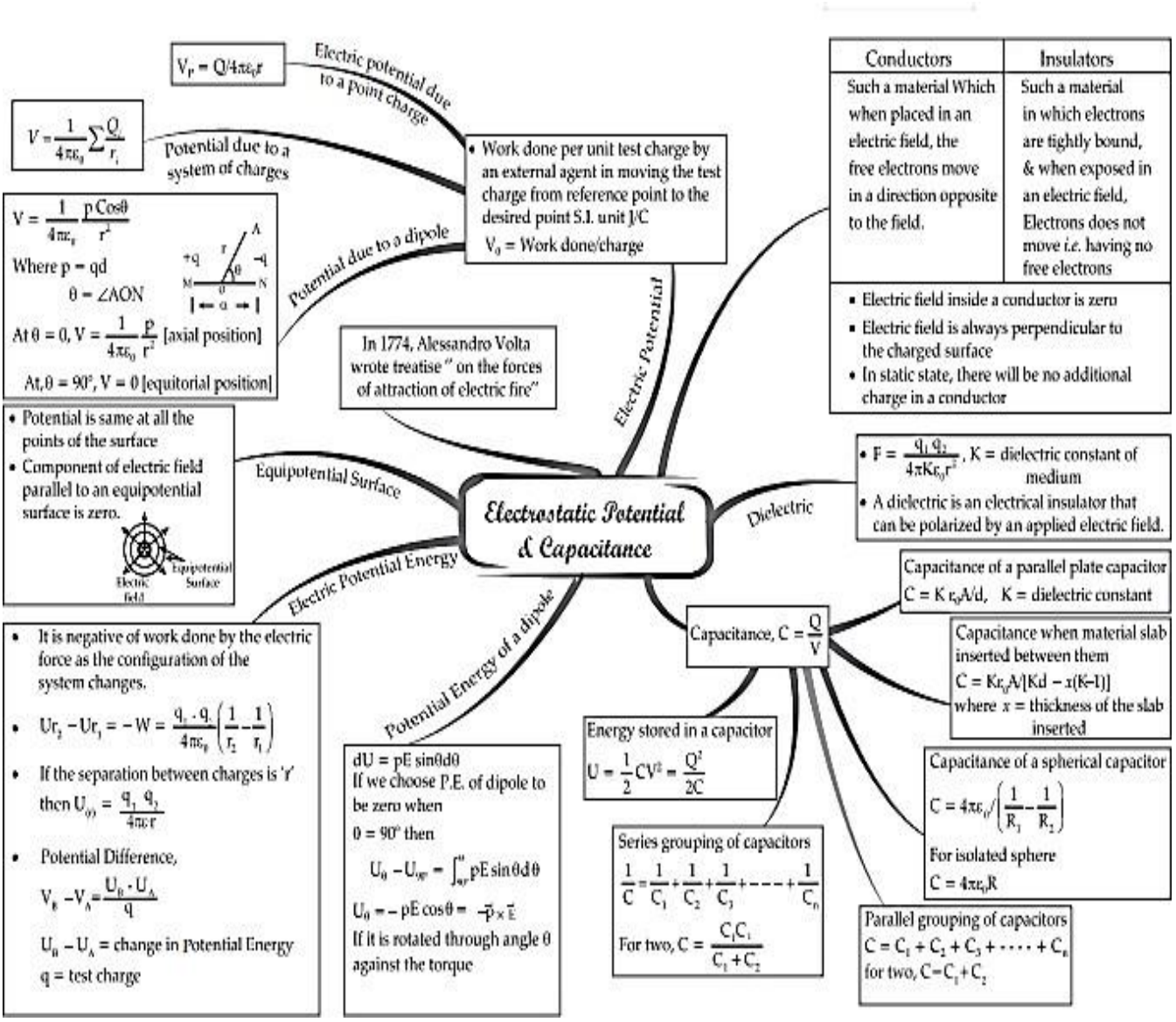
5. An electric dipole of moment p is placed in an electric field of intensity E. The dipole acquires a position such that the axis of the dipole makes an angle with the direction of the field. Assuming that potential energy of the dipole to be zero when $\theta = 90°$, the torque and the potential energy of the dipole will respectively be

(a) $pE\sin\theta, -pE\cos\theta$ (b) $pE\sin\theta, -2pE\cos\theta$

(c) $pE\sin\theta, 2pE\cos\theta$ (d) $pE\cos\theta, -pE\sin\theta$

CHAPTER 2 - ELECTROSTATIC POTENTIAL AND CAPACITANCE

MIND MAP

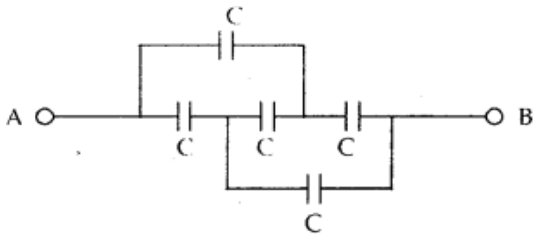


MULTIPLE CHOICE QUESTIONS

1 Three capacitors of capacitances 3μF, 9μF and 18 μF are connected once in series and then in parallel. The ratio of equivalent capacitances C_s/C_p will be:

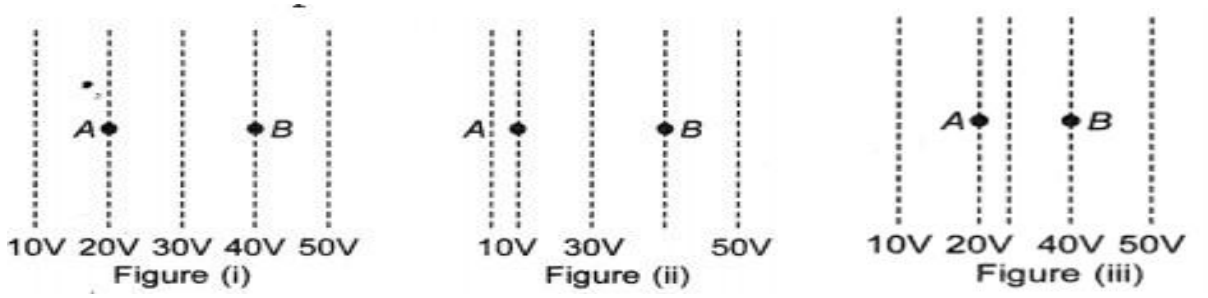
(a)1:15 (b)15:1 (c)1:1 (d) 1: 3

2 Five equal capacitors, each with capacitance C are connected as shown. The equivalent capacitance between A and B is.



(a)5 C (b) C (c) C/5 (d) 3C.

3 Figures show some equipotential lines distributed in space. A charged object is moved from point A to point B.



(a) The work done in Fig. (i) is the greatest.

(b) The work done in Fig. (ii) is least.

(c) The work done is the same in Fig. (i), Fig.(ii) and Fig. (iii).

(d) The work done in Fig. (iii) is greater than Fig. (ii) but equal to that in Fig. (i).

4 The electric potential V at any point O (x, y, z all in metres) in space is given by $V = 4x^2$ volt. The electric field at the point (1 m, 0, 2 m) in volt/metre is

(a) 8 along negative x-axis (b) 8 along positive x-axis

(c) 16 along negative x-axis (d) 16 along positive z-axis

5 Which of the following options is correct? In a region of constant potential

(a) the electric field is uniform.

(b) The electric field is zero.

(c) There can be charge inside the region.

(d) The electric field shall necessarily change if a charge is placed outside the region.

6 In a parallel plate capacitor, the capacity increases if

(a) area of the plate is decreased.

(b) Distance between the plates increases.

(c) Area of the plate is increased.

(d) Dielectric constantly decreases.

7 If a unit positive charge is taken from one point to another over an equipotential surface, then

(a) work is done on the charge. (b) work is done by the charge.

(c) work done is constant. (d) no work is done.

8 Twenty-seven drops of mercury are charged simultaneously to the same potential of 10 volts. What will be potential if all the charged drops are made to combine to form one large drop ?

(a)180 V (b) 90 V (c) 120 V (d) 45 V

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

(a) capacitance will increase. (b) energy stored will decrease.

(c) electric field will increase. (d) voltage will decrease.

10 Which of the following is blocked by a capacitor?

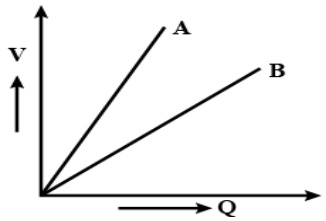
(a) A.C. (b) D.C. (c) Both A.C. and D.C. (d) Neither A.C. nor D. C

11 A dielectric is placed in between the two parallel plates of a capacitor as shown in the figure. The dielectric constant of the dielectric being K. If the initial capacity is C, then the new capacity will be:

(a)(K + l).C (b) K.C (c) ((K+1)/2) . C (d) (k – l) C

12 The graph shows the variation of voltage 'V' across the plates of two capacitors A and B versus increase of charge 'Q' stored on them. which of the two capacitors has higher capacitance?

(a) A (b) B (c) both have same (d) none



13 Two spherical conductors each of capacity C are charged to potential V and -V. These are then connected by means of a fine wire. The loss of energy is

(a) zero (b) $1/2CV^2$ (c) CV^2 (d) $2\ CV^2$

14. A positively charged particle is released from rest in a uniform electric field. The electric potential energy of the charge

(a) remains constant because the electric field is uniform.

(b)increases because charge moves along the electric field.

(c)decreases because charge moves along the electric field.

(d)decreases because charge moves opposite to the electric field.

15. Electric potential of earth is taken to be zero because earth is a good

(a) Insulator (b). Conductor (c). Semiconductor (d). Dielectric

ASSERTION REASONING QUESTIONS

These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.

(a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.

(b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.

(c) If the Assertion is correct but Reason is incorrect.

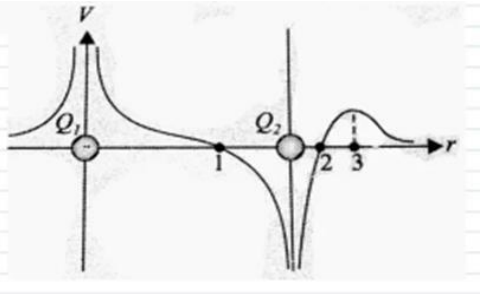
(d) If both the Assertion and Reason are incorrect.

1. Assertion: If the distance between parallel plates of a capacitor is halved and dielectric constant is three times, then the capacitance becomes 6 times.
   Reason : Capacity of the capacitor does not depend upon the nature of the material.
2. Assertion : Two concentric charged shells are given. The potential difference between the shells depends on charge of inner shell.
   Reason : Potential due to charge of outer shell remains same at every point inside the sphere.
3. Assertion : Electric field inside a conductor is zero.
   Reason: The potential at all the points inside a conductor is same.
4. Assertion : Work done in moving a charge between any two points in an electric field is independent of the path followed by the charge, between these points.
   Reason: Electrostatic force is a non-conservative force.
5. Assertion : Polar molecules do not have permanent dipole moment.
   Reason : In polar molecules, the centres of positive and negative charges coincide even when there is no external field.
6. Assertion: A capacitor can be given only a limited quantity of charge.
   Reason: Charge stored by a capacitor depends on the shape and size of plates of capacitor and the surrounding medium.
7. Assertion: Electron move away from a region of lower potential to a region of higher potential.
   Reason: An electron has a negative charge.
8. Assertion: A charged capacitor is disconnected from a battery. Now, if its plate are separated further, the potential energy will fall.
   Reason Energy stored in a capacitor is equal to the work done in charging it.
9. Assertion: Due to two-point charges electric field and electric potential can't be zero at some point simultaneously
   Reason Field is a vector quantity and potential a scalar quantity.

10. Assertion: A parallel plate capacitor is connected across battery through a key. A dielectric slab of dielectric constant k is introduced between the plates. The energy stored becomes k times.
Reason The surface density of charge on the plate remains constant.

CASE STUDY BASED QUESTIONS

1. The potential at any observation point P of a static electric field is defined as the work done by the external agent (or negative of work done by electrostatic field) in slowly bringing a unit positive point charge from infinity to the observation point. Figure shows the potential variation along the line of charges. Two-point charges Q_1 and Q_2 lie along a line at a distance from each other.



(i) At which of the points 1, 2 and 3 is the electric field is zero?

(a) 1 (b)2 (c) 3 (d) Both (a) and (b)

(ii) The signs of charges Q_1 and Q_2 respectively are

(a) positive and negative
(b) negative and positive
(a) positive and positive
(b) negative and negative

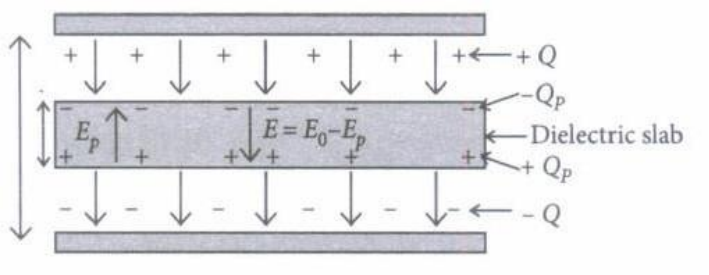
(iii) Which of the two charges Q_1 and Q_2 is greater in magnitude?

(a) Q_1 (b)Q_2 (c)cannot determine (d) same

(iv) Which of the following statement is not true?

(a)Electrostatic force is a conservative force.
(b) Potential at a point is the work done per unit charge in bringing a charge from infinity to that point in an electric field.
(c) Electrostatic force is non-conservative.
(d)Potential is the ratio of work to charge.

2. A dielectric slab is a substance which does not allow the flow of charges through it but permits them to exert electrostatic forces on one another.
When a dielectric slab is placed between the plates, the field E_o polarises the dielectric. This induces charge $-Q_p$ on the upper surface and $+ Q_p$ on the lower surface of the dielectric. These induced charges set up a field E_p inside the dielectric in the opposite direction of E_0 as shown.



(i) In a parallel plate capacitor, the capacitance increases from 4μF to 80μF on introducing a dielectric medium between the plates. What is the dielectric constant of the medium?

(a)10 (b) 20 (c)50 (d) 100

(ii) A parallel plate capacitor with air between the plates has a capacitance of 8 pF. The separation between the plates is now reduced half and the space between them is filled with a medium of dielectric constant 5. Calculate the value of capacitance of the capacitor in second case.

(a) 8pF (b) 10pF (c) 80pF (d) 100pF

(iii) A dielectric introduced between the plates of a parallel plate condenser

(a) decreases the electric field between the plates

(b) increases the capacity of the condenser

(c) increases the charge stored in the condenser

(d) increases the capacity of the condense

(iv) A parallel plate capacitor of capacitance 1 pF has separation between the plates is d. When the distance of separation becomes 2d and wax of dielectric constant x is inserted in it the capacitance becomes 2 pF. What is the value of x

(a) 2 (b) 4 (c) 6 (d) 8

ANSWERS
MULTIPLE CHOICE QUESTIONS

SNO	ANS MCQs	SNO	ANS A&R
1	(a)	1	(c)
2	(b)	2	(a)
3	(c)	3	(a)
4	(a)	4	(c)
5	(b)	5	(c)
6	(c)	6	(a)
7	(d)	7	(a)
8	(b)	8	(d)
9	(c)	9.	(b)
10	(b)	10.	(c)
11	(c)		**ANS CSB**
12	(a)	1 (i)	(c)
13	(c)	(ii)	(a)
14	(c)	(iii)	(a)
15	(b)	(iv)	(c)

		2. (i)	(b)
		(ii)	(c)
		(iii)	(d)
		(iv)	(b)

TEST PAPER
MULTIPLE CHOICE QUESTIONS

1. Two small spheres each carrying a charge q are placed r meter apart. If one of the spheres is taken around the other one in a circular path of radius r, the work done will be equal to
   (a) force between them × r (b) force between them × 2πr
   (c) force between them/2πr (d) zero
2. The electric potential V at any point O (x, y, z all in meters) in space is given by $V = 4x^2$ volt. The electric field at the point (1 m, 0, 2 m) in volt/meter is
   (a) 8 along negative x-axis (b) 8 along positive x-axis
   (c) 16 along negative x-axis (d) 16 along positive z-axis
3. If a unit positive charge is taken from one point to another over an equipotential surface, then
   (a) work is done on the charge. (b) work is done by the charge.
   (c) work done is constant. (d) No work is done
4. A hollow metal sphere of radius 5 cm is charged so that the potential on its surface is 10 V. The potential at the centre of the sphere is
   (a) 0 V (b) 10 V
   (c) Same as at point 5 cm away from the surface
   (d) Same as at point 25 cm away from the surface
5. The electrostatic force between the metal plates of an isolated parallel plate capacitor C having a charge Q and area A, is
   (a) proportional to the square root of the distance between the plates.
   (b) Linearly proportional to the distance between the plates.
   (c) Independent of the distance between the plates.
   (d) Inversely proportional to the distance between the plates.
6. A capacitor is charged by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system
   (a) increases by a factor of 4. (b) Decreases by a factor of 2.
   (c) Remains the same. (d) Increases by a factor of 2
7. Assertion (A): Sensitive instruments can protect from outside electrical influence by enclosing them in a hollow conductor.
   Reason (R): Potential inside the cavity is zero.

8. Assertion (A): Electrostatic forces are conservative in nature.

Reason (R): Work done by electrostatic force is path dependent.

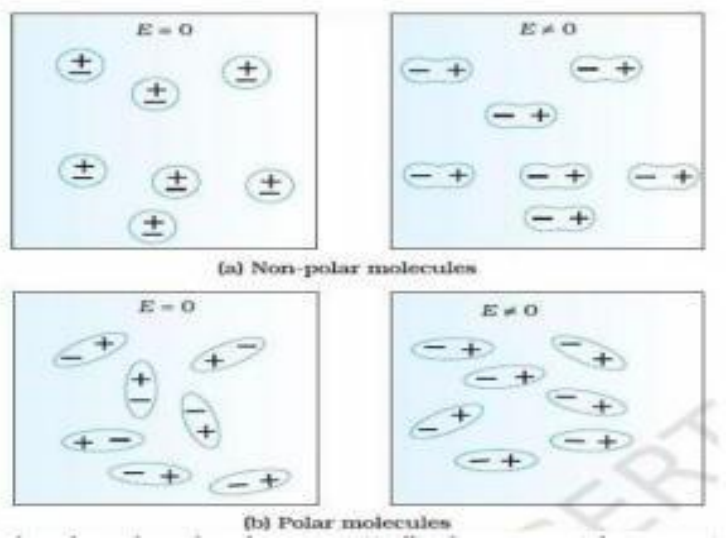
9. CASE STUDY BASE

Attempt any 4 sub parts out of 5 of question.

Dielectric with polar molecules also develops a net dipole moment in an external field, but for a different reason. In the absence of any external field, the different permanent dipoles are oriented randomly due to thermal agitation; so, the total dipole moment is zero. When an external field is applied, the individual dipole moments tend to align with the field. When summed overall the molecules, there is then a net dipole moment in the direction of the external field, i.e., the dielectric is polarized. The extent of polarisation depends on the relative strength of two factors: the dipole

potential energy in the external field tending to align the dipoles mutually opposite with the field and thermal energy tending to disrupt the alignment. There may be, in addition, the 'induced dipole moment' effect as for non-polar molecules, but generally the alignment effect is more important for polar molecules. Thus, in either case, whether polar or non-polar, a dielectric develops a net dipole moment in the presence of an external field. The dipole moment per unit volume is called polarization.

(i) The best definition of polarisation is



(a) Orientation of dipoles in random direction (b) Electric dipole moment per unit volume

(c) Orientation of dipole moments (d)Change in polarity of every dipole

(ii) Calculate the polarisation vector of the material which has 100 dipoles per unit volume in a volume of 2 units.

(a) 200 (b) 50 (c) 0.02 (d) 100

(iii) The total polarisation of a material is the

(a) Product of all types of polarisation (b) Sum of all types of polarisation

(c)Orientation directions of the dipoles (d)Total dipole moments in the material

(iv) Dipoles are created when dielectric is placed in _____

(a) Magnetic Field (b) Electric field

(c) Vacuum (d) Inert Environment

(v) Identify which type of polarisation depends on temperature.

(a)Electronic (b)Ionic (c) Orientational (d) Interfacial

CHAPTER 3 - CURRENT ELECTRICITY

MIND MAP

Important formula

$I=\Delta Q/\Delta t I=nqAvd$ $\rho=\rho 0\,(1+\alpha\Delta T)$ $R=R0\,(1+\alpha\Delta T)$

$P=IV=V^2/R=I^2R$ Current density: j = i/A = σE

Drift speed: vd = eE m/ τ = i Resistance of a wire: R = ρl/A, where ρ = 1/σ

Temp. dependence of resistance: R = R0(1 + αΔT) Ohm's law: V = iR

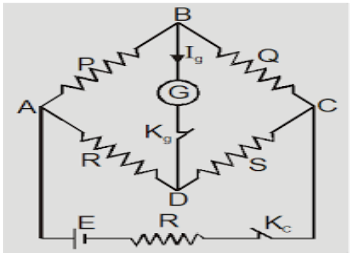
Kirchhoff 's Laws: (i) The Junction Law: The algebraic sum of all the currents directed towards a node is zero i.e., Σnode I = 0.

(ii)The Loop Law: The algebraic sum of all the potential differences along a closed loop in a circuit is zero i.e., Σloop Δ Vi = 0.

Resistors in parallel: 1 Req = R1 R2 /R1+R2 R1 Resistors in series: Req = R1 + R2

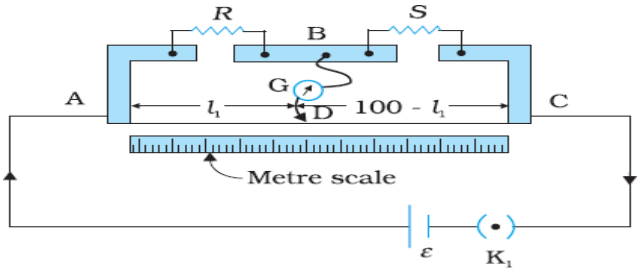
B Wheatstone bridge P/Q=R/S if bridge is in Balance condition

:

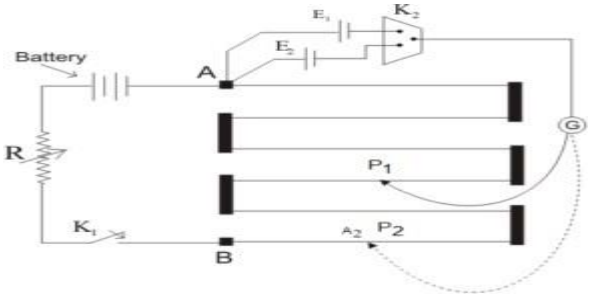


R /S= l/ 100-l if bridge is in balance condition

Circuit diagram for meter bridge



Potentiometer



To compare EMF of primary cells E1/E2=l1/ll2

MULTIPLE CHOICE QUESTIONS

1. The filament of 60W and 100 W bulbs are of same length. Then:

   (a) 60W filament is thicker (b) 100W filament is thicker

   (b)both are of same thickness (d)both cannot have same length

2. Kirchhoff's first law (∑i=o) and second law(∑iR=∑E),where the symbols have their usual meanings, are respectively based on:

   (a)Conservation of charge, conservation of momentum

   (b)Conservation of energy, conservation of charge

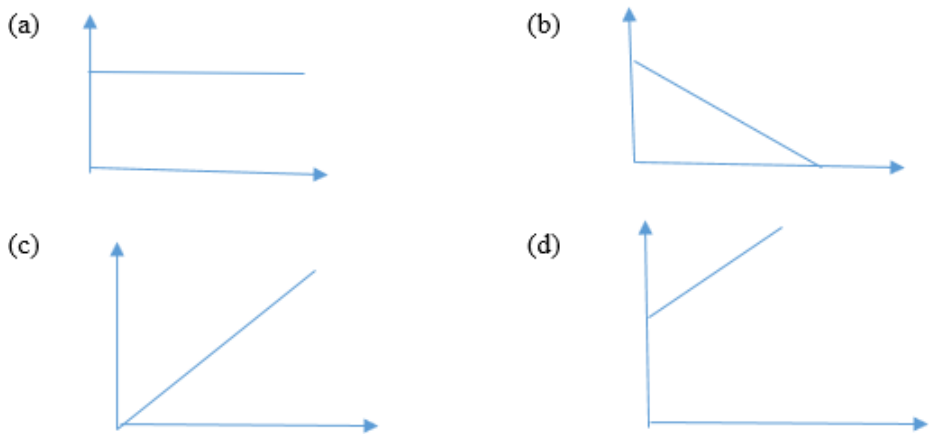
   (c) Conservation of momentum, conservation of charge

   (d)Conservation of charge, conservation of energy

3. Drift velocity of the free electrons in a conducting wire carrying a current i is v. If in a wire of the same metal, but of double the radius, the current be 2i then the drift velocity of the electrons will be

   (a) v/4 (b) v/2 (c) v (d) 4v

4. Following are the graphs between the current I drawn from a cell and the terminal voltage V of the cell. Which one is correct in(In Y axis V and in x axis I)



5. If a wire is stretched to make it double longer, its resistance will

   (a)Increase by 4 times (b)increase by 2

   (c)decrease by 4 times (d) decrease by 2times

6. In a meter bridge experiment the ratio of left gap resistance to right gap resistance is 1:3.The balance point from left is:

   (a)20cm (b)25cm (c)30cm (d)35cm

7. When a metal conductor connect to left gap of a meter bridge is heated the balancing point

   (a) shifts towards right (b) shifts towards left

   (c) remains unchanged (d)remains to zero

8. The specific resistance of a conductor increase with

(a) increase in temperature (b)increase in cross-sectional area

(c) decrease in length (d)decrease in cross-sectional area

9. In a current carrying conductor the net charge is

(a) $1.6X10^{-19}C$ (b) $6.25X10^{-18}C$ (c)zero (d)infinite

10 Nichrome or Manganin is widely used in wire bound resistors because of their

(a)temperature independent resistivity

(b)very weak temperature dependent resistivity

(c)strong dependence of resistivity with temperature

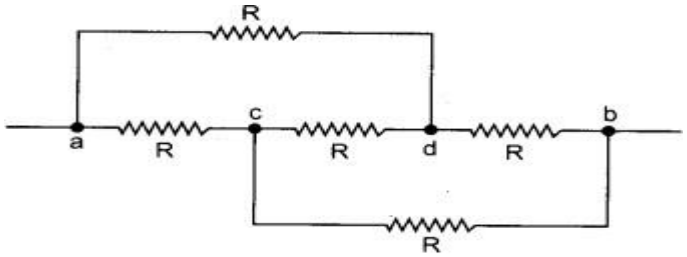
(d)mechanical strength

11. A current pass through a wire of nonuniform cross section. Which of the following quantities are independent of cross section

(a) the charge crossing (b)Drift velocity

(c)current density (d)free electron density

12. In below circuit if the value of each resistance is 10 Ω then equivalent resistance between a and b is



(a)10 Ω (b)20 Ω (c)30 Ω (a)40 Ω

13. The resistance of silver wire at 0^0 is 1.25 Ω. Up to what temperature it must be heated so that its resistance is doubled? (givenα for silver=0.0041^0C^{-1})

(a)350^0C (b)200^0C (c)244^0C (d)300^0C

14. A cell having emf of 1.5V, when connected across a resistance of 14 Ω, produces a voltage of only 1.4V across the resistance. The internal resistance of the cell must be

(a)1Ω (b)14Ω (c)15Ω (d)21Ω

15. Two conducting wires X and Y of same diameter but different materials are joined in series across a battery. If the number density of electron in X is twice that in Y, find the ratio of drift velocity of electrons in two wires is

(a)1:2 (b)1:1 (c)2:1 (d)3:2

For question 1 to 10 two statements are given –one labelled Assertion(A) and the other labelled Reason (R).Select the correct answer to these question from the codes (a),(b),(c)and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and R is NOT the correct explanation of A

(c)A is true but R is false

(d)A is false and R is also false

1. Assertion. Though large number of free electrons are present in the metal. Yet there is no current in the absence of electric field.
   Reason: In the absence of electric field electrons move randomly in all direction.
2. Assertion. An electrical bulb starts glowing instantly as it is switched on.
   Reason: Drift speed of electrons in a metallic wire is very large
3. Assertion: The emf of driver cell in potentiometer experiment should be greater than emf of cell to be determined.
   Reason: The fall of potential across the potentiometer wire should not be less than emf of cell to be determined.
4. Assertion: In meter bridge experiment, a high resistance is always connected in series with galvanometer.
   Reason: As resistance increase current more accurately than ammeter.
5. Assertion-Two electric bulb of 50W and 100 Ware given. When connected in series 50 W bulb glows more but when connected parallel100W bulb glows more.
   Reason-In series combination power is directly proportional to the resistance of the resistance of circuit. But in parallel combination power is inversely proportional to the resistance of the circuit.
6. Assertion- The average time of collision decreases with increasing temperature.
   Reason-At increased temperature average speed of the electrons, which act as the carrier of current increases resulting in more frequent collision.
7. Assertion-Two bulbs of same wattage, one having a carbon filament and the other having a metallic filament are connected in series. Mettalic bulbs will glow more brightly than carbon filament bulb
   Reason-Carbon is a semiconductor.
8. Assertion-Practically a voltmeter will measure the voltage across the battery not its emf.
   Reason-EMF of cell is measured with the help of potentiometer.
9. Assertion -Ohm's law is universally applicable for all conducting elements
   Reason-All conducting elements show straight line graphic variation on (I-V)plot.
10. Assertion-The potentiometer wire should have uniform cross sectional area.
    Reason-on potentiometer wire the jockey is gently touched, not pressed hard

CASE STUDY QUESTION

1. Electron move more easily through some conductors than others when potential difference is applied. The opposition of a conductor to current is is called its resistance. Collisions are the basic cause of opposition. When potential difference is applied across the ends of a conductor, its free electrons get accelerated. On their way, they frequently collide with positive metal ions, i.e., their motion is opposed and this opposition to the flow of electron is called resistance. The number of collisions that the electrons make with atoms/ions depends on the arrangement of atoms or ions in the conductor. A long wire offers more resistance than short wire because there will be more collisions. A thick wire offers less resistance than a thin wire because in a thick wire more area of cross section is available for the flow of electrons. The resistance of metal increases when their temperature increases. Certain alloys such as constantan and manganin show very small changes of resistance with temperature and are used to make standard resistors. The resistance of semiconductor and insulator decreases as their temperature increases.

Questions

(i). The resistance of a conductor is

(a) inversely proportional to the length

(b) directly proportional to the square of the radius

(c) inversely proportional to the square of the radius

(d) directly proportional to the square root of the length.

(ii). The dimensions of a block are $1cm \times 1cm \times 100cm$. If the specific resistance of the material is $3X10^{-7}\Omega$ then the resistance between two opposite rectangular base is

(a) $3X10^{-9}\Omega m$ (b) $3X10^{-7}\Omega$ (c) $3X10^{-5}\Omega$ (d) $3X10^{-1}\Omega$

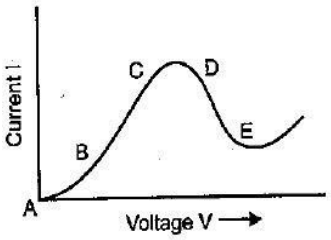
(iii). Two wire of the same material have lengths I and 2l and areas of cross section 4A and A respectively. The ratio of their specific resistance would be

(a)1:2 (b)8:1 (c)1:8 (d) 1:1

(iv). A wire of resistance R is stretched to twice of its original length.Its new resistance will be

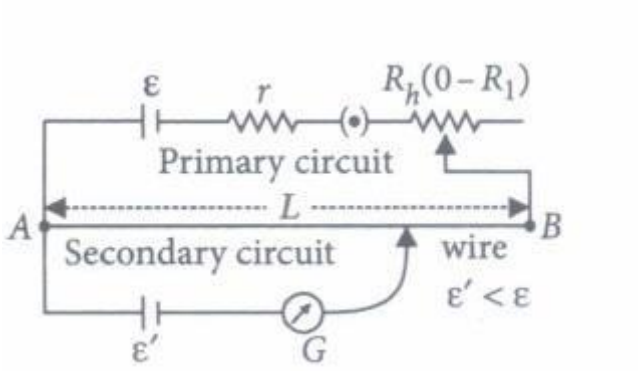
(a)4R (b)R/9 (c)3R (d)R/3

(v). From the graph between current I and V identify the portion corresponding to the negative resistance



(a) AB (b)BC (c)CD (d)DE

2. Potentiometer is an apparatus used for measuring the emf of a cell or potential difference between two points in an electrical circuit accurately. It is also used to determine the internal resistance of a primary cell. The potentiometer is based on the principle that, if V is the potential difference across any portion of the wire of length l and resistance R, then $V \propto l$ or $V=kl$ where k is the potential gradient. Thus, potential difference across any portion of potentiometer wire



is directly proportional to length of the wire of that portion. The potentiometer wire must be uniform. The resistance of potentiometer wire should be high.

Questions

(i) Which one of the following is true about potentiometer?

(a) Its sensitivity is low

(b) It measures the emf of a cell very accurately

(c) It is based on deflection method

(d) None of the above

(ii) A current of 1.0 mA is flowing through a potentiometer wire of length 4 m and of resistance 4Ω .The potential gradient of the potentiometer wire is

(a) 10^{-3}V/m **(b)** 10^{-4}V/m (c) 10^{-2}V/m (d) 10^{-1}V/m

(iii) Sensitivity of a potentiometer can be increased by

(a) decreasing potential gradient along the wire (b) increasing potential gradient along the wire

(c) decreasing current through the wire (d) increasing current through the wire

(iv) A potentiometer is an accurate and versatile device to make electrical measurements of EMF because the method involves

(a) potential gradients

(b) a condition of no current flow through the galvanometer

(c) a combination of cells, galvanometer and resistances

(d) cells

(v) In a potentiometer experiment, the balancing length is 8 m, when the two cells E_1 and E_2 are joined in series. When the two cells are connected in opposition the balancing length is 4 m. The ratio of the e. m. f. of two cells (E_1/E_2) is

(a) 1: 2 (b) 2: 1 (c) 1: 3 (d) 3: 1

ANSWERS

MULTIPLE CHOICE QUESTIONS

1. $P=V^2/R$ for more power less resistance hence 100W bulb has low resistance and resistance is inversely proportion to cross section are so 100 W bulb is more thicker.

2 (d)

3(b)$I = neAV_d$ as per question $I=ne\pi r^2V$ than for $2I= ne\pi(2r)^2 V_2$ by solving V2=V/2

4(b) V=E-Ir

5(a)For stretching volume remain constant hence l1A1=l2A2 therefore A1/A2=l2/l1

As per the question l2=2l1 hence A1/A2=2/1

R2/R1=(l2/l1)X(A1/A2)=2X2 =4

6 (b)for meter bridge P/Q=R/S i.e. 1/3 =l/100-l by solving l=25

7 (a) When conductor heated its resistance increases hence length from left hand side also increases.

8 (a)specific resistance depends on temperature and independent by length and cross section area

9 (c)

10 (b)

11(d)

12(a) another form of wheat stone bridge

13(c) $\Delta R=\alpha R\ \Delta T$ in this case $\Delta R=R$

Thererfore $\Delta T=1/\alpha$ by solving $\Delta T=244$

Final temperature $T=T+\Delta T=0+244=244$

14.(a) r=R(E/V -1) R=14 E=1.5 V=1.4 by putting values r=1

15(a) In series current remains same $I_x=I_y$

$en_xAv_d(x)= en_yAv_d(y)$ as per the question ny/nx=1/2 by solving $v_d(x)/v_d(y)=1/2$

ASSERTION AND REASONING QUESTIONS

1.(a) 2(c) drift speed of electron is very small.

3(a) 4(c)resistance is connected for the protection of galvanometer.

5(a) 6(a) 7(d) 8(b) 9(d) 10(b)

CASE STUDY-BASED QUESTIONS

Case study 1.

(i) (c) $R=\rho l/A= \rho l/\pi r^2$

(ii) (b) $R=\rho l/A=(3.7X10^{-7}X10^{-2})/1X10^{-2}=3.7X10^{-7}$

(iii) (d) The specific resistance does not depend upon l and A depends upon nature of material

(iv) (a) R2/R1=l2XA1/l1XA2 when stretch volume remains constant hence l1A1=2l1XA2

A1/A2=2/1

henceR2/R1=(l2/l1)XA1/A2=2X2=4

(v)(c)In portion CD current decrease with increase in voltage

Case Study 2.

(i)(b)

(ii) (a)$V=IR=10^{-3}X4$

$K=V/l=10^{-3}X4/4=10^{-3}V/m$

(iii) (a)

(iv) (b)

(v). (d)(E1+E2)/(E1-E2)=8/4 by solving E1/E2=3/1

CHAPTER 4 - MOVING CHARGES AND MAGNETISM

MULTIPLE CHOICE QUESTIONS

1. Biot-Savart law indicates that the moving electrons (velocity v) produce a magnetic field B such that

(a) B Perpendicular to **v**

(b) B || v

(c) It obeys inverse cube law.

(d) It is along the line joining the electron and point of observation

2. An electron is projected with uniform velocity along the axis of a current carrying long Solenoid. Which of the following is true?

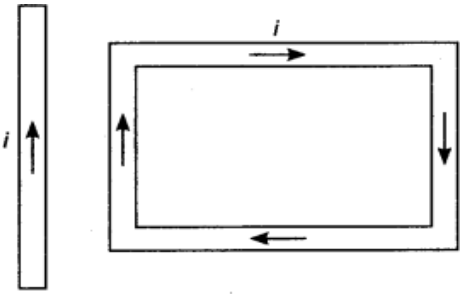
(a) The electron will be accelerated along the axis.

(b) The electron path will be circular about the axis.

(c) The electron will experience a force at 45° to the axis and hence execute a helical path.

(d) The electron will continue to move with uniform velocity along the axis of the solenoid.

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



(a) Rotate about an axis parallel to the wire.

(b) Move away from the wire or towards right.

(c) Move towards the wire or towards Left.

(d) Remain stationary.

4. A wire in the form of a circular loop, of one turn carrying a current, produces magnetic induction B at the centre. If the same wire is looped into a coil of two turns and carries the same current, the new value of magnetic induction at the centre is

(a) B (b) 2 B (c) 4 B (d) 8 B

5. A solenoid has 1000 turns per meter length. If a current of 5A is flowing through it, then magnetic field inside the solenoid is

(a) $2\pi \times 10^{-3}$ T (b) $2\pi \times 10^{-5}$ T

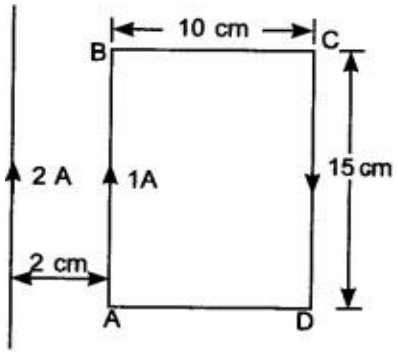
(c) $4\pi \times 10^{-3}$ T (d) $4\pi \times 10^{-5}$ T

6. The coil of a moving coil galvanometer is wound over a metal frame in order to

(a) Reduce hysteresis (b) increase sensitivity

(c) Increase moment of inertia (d) provide electromagnetic damping

7. What is the net force on the rectangular coil?



(a) 25 X 10^{-7} N towards wire. (b) 25 × 10^{-7} N away from wire.
(c) 35 × 10^{-7} N towards wire. (d) 35 × 10^{-7} N away from wire.

8. If the beams of electrons and protons move parallel to each other in the same direction, then they

(a) Attract each other. (b) Repel each other.

(c) No relation. (d) Neither attracts nor repel.

9. Currents of 10 A and 2 A are flowing in opposite directions through two parallel wires A and B respectively. If the wire A is infinitely long and wire B is 2 m long, then force on wire B which is situated at 10 cm from A, is

(a) 8 X 10^{-5} N

(b) 6 X 10^{-5} N

(c) 4 X 10^{-5} N

(d) 2 X 10^{-5} N

10. A strong magnetic field is applied on a stationary electron. Then the electron

(a) Moves in the direction of the field.

(b) remained stationary.

(c) Moves perpendicular to the direction of the field.

(d) Moves opposite to the direction of the field.

11. 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) 8 times (b) 4 times (c) 2 times (d) 16 times

12. Two α-particles have the ratio of their velocities as 3 : 2 on entering the field. If they move in different circular paths, then the ratio of the radii of their paths is

(a) 3 : 2 (b) 2 : 3 (c) 4 : 9 (d) 9 : 4

13. A current carrying loop is placed in a uniform magnetic field. The torque acting on it does not depend upon

(a) Area of loop (b) Value of current

(c) Magnetic field (d) None of these

14. If a current I is flowing in a straight wire parallel to x axis and magnetic field is there along the y axis then

(a) The wire experiences force in x direction

(b) The wire experiences force in y direction

(c) The wire experiences no force

(d) The wire experiences force in z direction

15. Two wires of same length are shaped into a square and a circle if they carry same current, ratio of magnetic moment is :

(a) 2 : π (b) π : 2 (c) 4 : π (d) π : 4

16. Current sensitivity of a galvanometer can be increased by decreasing :

(a) Magnetic field B (b) Number of turns N

(c) spring constant K (d) Area A

ASSERTON AND REASONING QUESTION

Instructions:

Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

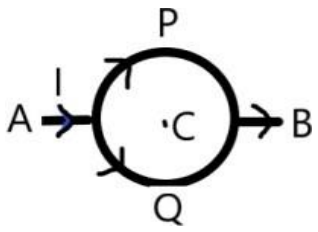
(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

(c) A is true but R is false

(d) A is false and R is also false

1. **Assertion (A):** The magnetic field at the centre of the current carrying circular coil shown in the fig. is zero.



Reason (R): The magnitudes of magnetic fields are equal and the directions of magnetic fields due to both the semicircles are opposite.

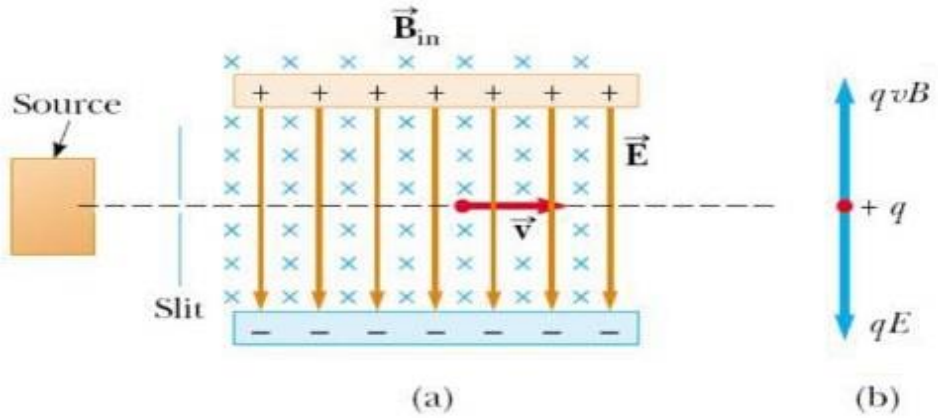
2. **Assertion (A):** The voltage sensitivity may not necessarily increase on increasing the current sensitivity.

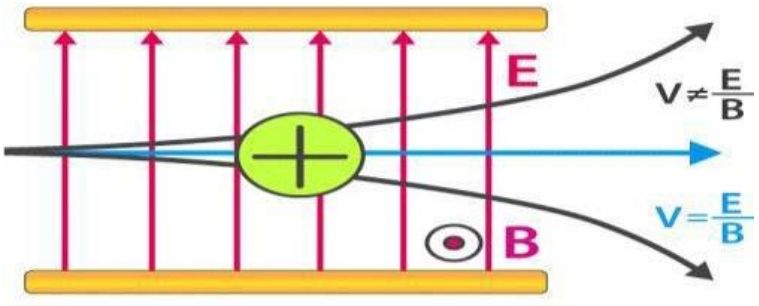
Reason (R): Current sensitivity increases on increasing the number of turns of the coil.

3. **Assertion (A):** If a proton and an α-particle enter a uniform magnetic field perpendicularly with the same speed, the time period of revolution of α-particle is double than that of proton.
   Reason (R): In a magnetic field, the period of revolution of a charged particle is directly proportional to the mass of the particle and inversely proportional to the charge of the particle.
4. **Assertion (A):** The magnetic field at the ends of a very long current carrying solenoid is half of that at the centre.
   Reason (R): If the solenoid is sufficiently long, the field within it is uniform.
5. **Assertion (A):** If an electron and proton enter a magnetic field with equal momentum, then the paths of both of them will be equally curved.
   Reason (R): The magnitude of charge on an electron is same as that on a proton.
6. **Assertion (A):** The coils of a spring come close to each other, when current is passed through it.
   Reason (R): It is because, the coils of a spring carry current in the same direction and hence attract each other.
7. **Assertion (A):** The range of a voltmeter can be both increased or decreased.
   Reason (R): The required resistance (to be connected in series) can be calculated by using the relation,
8. **Assertion (A):** An electron projected parallel to the direction of magnetic force will experience maximum force.
   Reason (R): Magnetic force on a charge particle is given by F = (IL x B).
9. **Assertion (A**): The torque acting on square and circular current carrying coils having equal areas, placed in uniform magnetic field, will be same.
   Reason (R): Torque acting on a current carrying coil placed in uniform magnetic field does not depend on the shape of the coil, if the areas of the coils are same.
10. **Assertion (A):** Magnetic field due to an infinite straight conductor varies inversely as the distance from it.
    Reason (R): The magnetic field due to a straight conductor is in the form of concentric circles.

CASE STUDY BASED QUESTION

1. **VELOCITY SELECTOR**





A charge q moving with a velocity **v** in presence of both electric and magnetic fields experience a force **F = q [E + v x B].** If electric and magnetic fields are perpendicular to each other and also perpendicular to the velocity of the particle, the electric and magnetic forces are in opposite directions. If we adjust the value of electric and magnetic field such that magnitude of the two forces is equal. The total force on the charge is zero and the charge will move in the fields un deflected.

1. What will be the value of velocity of the charge particle, when it moves un deflected in a region where the electric field is perpendicular to the magnetic field and the charge particle enters at right angles to the fields.

   (a) v = E/B (b) **v = B/E** **(c) v = EB** **(d) v = EB/q**

2. Proton, neutron, alpha particle and electron enter a region of uniform magnetic field with same
   velocities. The magnetic field is perpendicular to the velocity. Which particle will experience maximum force?

   (a) Proton (b) Electron (c) Alpha particle (d) Neutron

3. A charge particle moving with a constant velocity passing through a space without any change in the velocity. Which can be true about the region?

   (a) E = 0, B = 0 (b) E ≠ 0, B ≠ 0

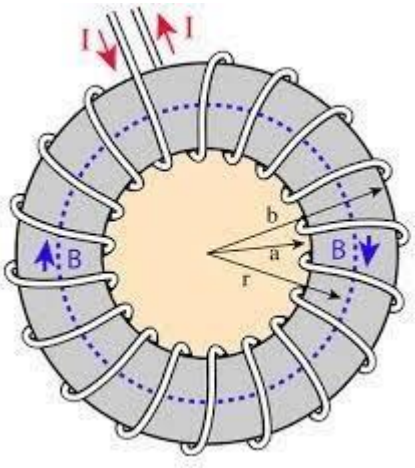
   (c) E = 0, B ≠ 0 (d) All of these

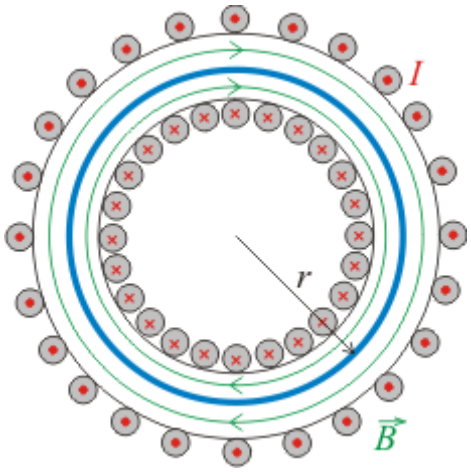
4. Proton, electron and deuteron enter a region of uniform magnetic field with same electric potential-difference at right angles to the field. Which one has a more curved trajectory?

(a) electron (b) Proton

(c) Deuteron (d) All will have same radius of circular path

II-TOROID





The toroid is a hollow circular ring on which a large number of turns of wire are closely wound. It can be viewed as a solenoid which has been bent into a circular shape to close on itself. The magnetic field vanishes in the open space inside and outside the toroid. The magnetic field inside the toroid is constant in magnitude and is given by B = μ0 n I, where n is the number of turns per unit length and I is the current flowing in the toriod, μ0 is the absolute permeability of the free space.

1. The magnetic field inside a toroid of radius R is B. If the current through it is doubled and its radius is also doubled keeping the number of turns per unit length the same, magnetic field produced by it will be

(a) B/2 (b) B/4 (c) B (d) 2B

2. What is the magnetic field in the empty space enclosed by the toroid of radius R?

(a) $\mu_0 4\pi\, 2lR$ (b) Infinity (c) Zero (d) $\mu_0 4\pi\, \pi lR$

3. A toroid of 300 turns/m and radius 2 cm is carrying a current of 5 A. What is the magnitude of magnetic field intensity in the interior of the toriod?

(a) 1.9 T (b) 1.9×10^{-6} T (c) 1.9×10^{-3} T (d) 1.9×10^{-7} T

4. Magnetic field due to a current carrying toroid is independent of

(a) Its number of turns (b) Current

(c) Radius (d) None of these

5. How can you increase the magnetic field inside a toroid?

(a) by increasing the radius

(b) by decreasing the current

(c) by introducing a soft iron core inside a toroid

(d) by decreasing the total number of turns

ANSWER

MULTIPLE CHOICE QUESTION

1. a) **B** Perpendicular to **v**

2. (d) The electron will continue to move with uniform velocity along the axis of the solenoid.

3. (c) move towards the wire or towards Left

4. c) 4 B

5. (a) 2π X 10^{-3} T

6. (d) provide electromagnetic damping

7. (a) 25 X 10^{-7} N towards wire

8. (b) repel each other.

9. (c) 4 X 10^{-5} N

10. (b) remained stationary.

11. (b) 4 times

12. (a) 3 : 2

13. (d) None of these

14. (d) The wire experiences force in z direction

15. (d) π : 4

16. Spring constant K

ASSERTION AND REASONING QUESTION

1. (a) 2. (b) 3. (a) 4. (b) 5. (a) 6. (a) 7. (a) 8. (d) 9. (a) 10. (b)

CASE STUDY-BASED QUESTION

Q -1	1 (a)	2 (c)	3 (d)	4 (a)
Q -II	1 (d)	2 (c)	3 (c)	4 (b)

CHAPTER 5 - MAGNETISM AND MATTER

MULTIPLE CHOICE QUESTION

1. A circular coil of radius 4 cm and of 20 turns carries a current of 3 amperes. It is placed in a magnetic field of intensity of 0.5 Weber/m². The magnetic dipole moment of the coil is

   (a) 0.15 Am^2 (b) 0.3 Am^2 (c) 0.45 Am^2 (d) 0.6 Am^2

2. At a certain place on earth, $B_H=\sqrt{3}B_V$ angle of dip at this place is

   (a) 60° (b) 30° (c) 45° (d) 90°

3. The angle of dip at a certain place where the horizontal and vertical components of the earth's magnetic field are equal is

   (a) 30° (b) 75° (c) 60° (d) 45°

4. The angle between Magnetic meridian and the geographic meridian is known as

   (a) Angle of dip (b) magnetic field inclination

   (c) Magnetic field declination (d) angle of magnetism

5. Which of the following are the Elements of Earth's magnetic fields?

   (i) Magnetic declination

   (ii) Angle of dip or magnetic inclination

   (iii) Vertical component of earth's magnetic field

   (iv) Horizontal component of earth's magnetic field

   Choose the correct option

   (a) (i), (ii) and (iii) (b) (i), (ii) and (iv)

   (c) (ii), (iii) and (iv) (d) (i), (iii) and (iv)

6. Where on the surface of Earth is the vertical component of Earth' s magnetic field zero ?

   (a) at north pole (b) at South pole (c) at Equator (d) none of these

7. A small magnet is pivoted to move freely in the magnetic meridian. At what place on the surface of the earth will the magnet be vertical?

   (a) at pole (b) at the place where angle of dip is 45^0

   (c) at Equator (d) none of these

8. Which of the following are true

   (i) Angle of dip at equator is zero

   (ii) The value of Horizontal component of Earth's Magnetic Field is maximum at equator

   (iii) The value of Vertical component of Earth's Magnetic Field is maximum at equator

   (iv) The value of Horizontal component of Earth's Magnetic Field is minimum at Poles

   Choose the correct option

   (a) (i), (ii) and (iii) (b) (i), (ii) and (iv)

   (c) (ii), (iii) and (iv) (d) (i), (iii) and (iv)

9. An Electron in an atom revolves around the nucleus in an orbit of radius r with frequency f, the magnetic moment of electron is

(a) $ef\pi r^2$ (b) $ef\pi r^2/2$ (c) $2ef\pi r^2$ (d) $ef\pi r^2/3$

10. At the place the horizontal component of magnetic field is B and angle of dip is 60^0, the value of the horizontal component of magnetic field at equator is

(a) B (b) zero (c) 2B (d) B/2

ASSERTION AND REASONING QUESTIONS

Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true but R is not the correct explanation of A

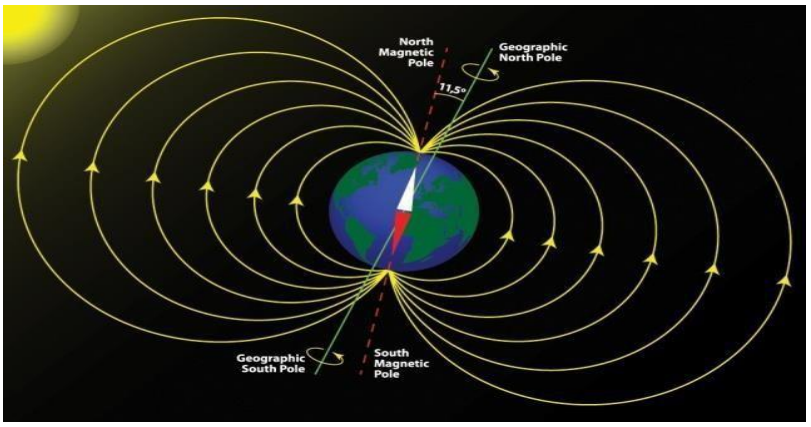
(c) A is true but R is false

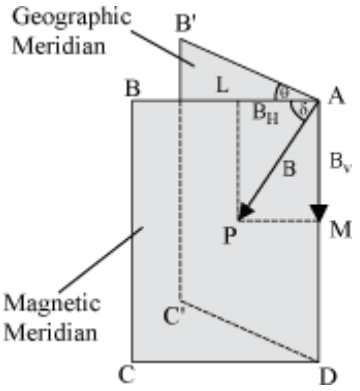
(d) A is false and R is also false

1. **Assertion (A):** The angle of dip is maximum at the poles of the earth.
   Reason (R): The magnetic field lines are parallel to the surface of the earth at the poles.
2. **Assertion (A):** Both A m2 and J T-1 are the units of magnetic dipole moment.
   Reason (R): Both the units are equivalent to each other.
3. **Assertion (A):** The true geographic north direction is found by using a compass needle.
   Reason (R): The magnetic meridian of the earth is along the axis of rotation of the earth.
4. **Assertion (A):** If a compass needle is kept at magnetic north pole of the earth, the compass needle may stay in any direction.
   Reason (R): Dip needle will stay vertical at the north pole of the earth.
5. **Assertion (A):** When radius of a circular loop carrying current is doubled, its magnetic moment becomes four times.
   Reason (R): Magnetic moment depends on the area of the loop.

CASE STUDY BASED QUESTIONS

EARTH'S MAGNETISM





The magnetic field lines of the earth resemble that of a hypothetical magnetic dipole located at the centre of the earth. The axis of the dipole does not coincide with the axis of rotation of the earth but is presently tilted by approximately 11.3° with respect to the later. If the magnetic needle is perfectly balanced about a horizontal axis so that it can swing in a plane of the magnetic meridian, the needle would make an angle with the horizontal. This is known as the angle of dip (also known as inclination).

1. What is the angle of dip at the equator?
   (a) 0° (b) 45° (c) 60° (d) 90°
2. At the poles, the dip needle will
   (a) stay horizontal
   (b) stay vertical
   (c) stays at 45° angle with the horizontal
   (d) does not remain steady in any fixed position
3. The angle of dip where the vertical component of the earth's magnetic field is equal to the horizontal component of the earth's magnetic field will be
   (a) 0° (b) 45° (c) 60° (d) 90°
4. Which of the following independent quantities is not used to specify the earth's magnetic field?
   (a) Magnetic declination (θ)
   (b) Vertical component of earth's magnetic field
   (c) Horizontal component of earth's magnetic field (B_H)
   (d)Angle of dip (δ)

ANSWER

MULTIPLE CHOICE QUESTION

1. (d) 0.6 Am^2 2. (b) 30° 3. (d) 45° 4. (c) Magnetic field declination

5. (b) (i), (ii) and (iv) 6. (c) at Equator 7. (a) at pole

8. (b) (i), (ii) and (iv) 9. (a) $ef\pi r^2$ 10. (c) 2B

ASSERTION AND REASON QUESTIONS

1. (c), 2. (a) , 3. (d), 4. (b) 5. (a)

CASE STUDY BASE TYPE QUESTIONS

1. (a), 2. (b) , 3. (b) 4. (b) ,

CHAPTER 6 - ELECTROMAGNETIC INDUCTION

MULTIPLE CHOICE QUESTIONS

1. When current in a coil change from 5 A to 2 A in 0.1 s, average voltage of 50V is produced. The self-inductance of the coil is

(a)1.67H (b)6H (c)3H (d) 0.67 H

2 A coil having 500 sq. loops of side 10 cm is placed normal to magnetic flux which increases at a rate of 1 T/s. The induced emf is

(a)0.1V (b)0.5V (c)1V (d) 5 V

3 Lenz's law of electromagnetic induction is as per law of conservation of

(a)energy. (b)Angular momentum

(c)charge. (d) Mass

4 The current flows from A to B is as shown in the figure. The direction of the induced current in the loop is

(a) clockwise. (b)anticlockwise.

(c)straight line. (d) no induced e.m.f. produce

5 In a coil of self-induction 5 H, the rate of change of current is 2 A/s. Then emf induced in the coil is

(a) 10 V (b) -10 V (c) 5 V (d) -5 V

6 A solenoid is connected to a battery so that a steady current flows through it. If an iron core is inserted into the solenoid, the current will

(a) increase (b) decrease

(c) remain same (d) first increase then decrease

7 Which of the following statements is not correct?

(a) Whenever the amount of magnetic flux linked with a circuit changes, an emf is induced in circuit.

(b) The induced emf lasts so long as the change in magnetic flux continues.

(c) The direction of induced emf is given by Lenz's law.

(d) Lenz's law is a consequence of the law of conservation of Charge.

8 There is a uniform magnetic field directed perpendicular and into the plane of the paper. An irregular shaped conducting loop is slowly changing into a circular loop in the plane of the paper. Then

(a) current is induced in the loop in the anti-clockwise direction.

(b) current is induced in the loop in the clockwise direction.

(c) ac is induced in the loop.

(d) no current is induced in the loop.

9 The north pole of a bar magnet is rapidly introduced into a solenoid at one end (say A). Which of the following statements correctly depicts the phenomenon taking place?

(a) No induced emf is developed.

(b) The end A of the solenoid behaves like a south pole.

(c) The end A of the solenoid behaves like north pole.

(d) The end A of the solenoid acquires positive potential.

10 Identify the wrong statement.

(a) Eddy currents are produced in a steady magnetic field.

(b) Eddy currents can be minimized by using laminated core.

(c) Induction furnace uses eddy current to produce heat.

(d) Eddy current can be used to produce braking force in moving trains.

11 If number of turns in primary and secondary coils is increased to two times each, the mutual inductance

(a) becomes 4 times (b) becomes 2 times

(c) becomes A times (d) remains unchanged 4

12 The magnetic flux linked with a coil of N turns of area of cross section A held with its plane parallel to the field B is

(a) $\frac{NAB}{2}$ (b) NAB (c) $\frac{NAB}{4}$ (d) zero

13 Direction of current induced in a wire moving in a magnetic field is found using

(a) Fleming's left hand rule (b) Fleming's right hand rule

(c) Ampere's rule (d) Right hand thumb rule

14 A solenoid is connected to a battery so that a steady current flows through it. If an iron core is inserted into the solenoid, the current will

(a) increase (b) decrease

(c) remain same (d) first increase then decrease

15 Which of the following does not use the application of eddy current?

(a) Electric power meters (b) Induction furnace

(c) LED lights (d) Magnetic brakes in trains

ASSERTION (A) & REASONING (R) QUESTIONS

Of the following statements, mark the correct Answers as

A - if both Assertion and Reason -- are true and Reason -- is correct explanation of the Assertion.

B - if both Assertion and Reason -- are true but Reason -- is not correct explanation of Assertion.

C - if Assertion is true but Reason -- is false.

D - if both Assertion and Reason -- are false.

1. Assertion- Eddy current is produced in any metallic conductor when magnetic flux is changed around it .

   Reason -- Electric potential determine the flow of charge.

2. Assertion -- The quantity L/R possesses dimensions of time.

   Reason -- to reduce the rate of increase of current through a solenoid should increase the time constant L/R

3. Assertion- Faraday laws are consequence of conservation of energy.

   Reason -- In a purely resistive AC circuit, the current lags behind the emf in phase.

4. Assertion- Only a change in magnetic flux through a coil maintain a current in the coil if the current is continues .

   Reason -- The presence of large magnetic flux through a coil maintain a current in the coil if the current is continues.

5. Assertion- Inductance coil are made of copper.

   Reason -- Induced current is more in wire having less resistance.

CASE STUDY BASED QUESTION

Electromagnetic induction is defined as the production of an electromotive force across an electric conductor in the changing magnetic field. The discovery of induction was done by Michael Faraday in the year 1831. Electromagnetic induction finds many applications such as in electrical components which includes transformers, inductors, and other devices such as electric motors and generators. Alternating current is defined as an electric current which reverse in direction periodically. In most of the electric power circuits, the waveform of alternating current is the sine wave.

1. How to increase the energy stored in an inductor by four times?

   (a) By doubling the current (b) This is not possible

   (c) By doubling the inductance (d) By making current 2 times

2. Consider an inductor whose linear dimensions are tripled and the total number of turns per unit length is kept constant, what happens to the self-inductance?

   (a) 9 times (b) 3 times (c) 27 times (d) 13 times

3. Lenz law is based on which of the following conservation

   (a) Charge (b) Mass (c) Momentum (d) Energy

4. What will be the acceleration of the falling bar magnet which passes through the ring such that the ring is held horizontally and the bar magnet is dropped along the axis of the ring?

   (a) It depends on the diameter of the ring and the length of the magnet

   (b) It is equal due to gravity

   (c) It is less than due to gravity

(d) It is more than due to gravity

ANSWERS

MULTIPLE CHOICE QUESTIONS

Q1	A	Q8	A
Q2	D	Q9	C
Q3	A	Q10	A
Q4	A	Q11	A
Q5	A	Q12	D
Q6	B	Q13	B
Q7	D	Q14	B
		Q15	C

ASSERTION AND REASONING QUESTIONS

Q1	B
Q2	B
Q3	C
Q4	C
Q5	A

CASE STUDY BASED QUESTION

1. (a) 2. (b) 3. (d) 4. (c)

TEST PAPER

1 If number of turns in primary and secondary coils is increased to two times each, the mutual inductance

(a) becomes 4 times (b) becomes 2 times

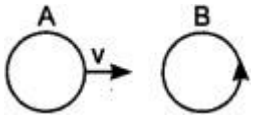
(c) becomes A times (d) remains unchanged 4

2 Two inductors of inductance. L each are connected in series with opposite? magnetic fluxes. The resultant inductance is

(Ignore mutual inductance)

(a) zero (b) L (c) 2L (d) 3L

3 There are two coils A and B as shown in Figure. A current start flowing in B as shown, when A is moved towards B and stops when A stops moving. The current in A is counterclockwise. B is kept stationary when A moves. We can infer that



(a) there is a constant current in the clockwise direction in A.

(b) there is a varying current in A.

(c) there is no current in A.

(d) there is a constant current in the counter clockwise direction in A.

4 An e.m.f is produced in a coil, which is not connected to an external voltage source. This is not due to

(a) the coil being in a time varying magnetic field.

(b) the coil moving in a time varying magnetic field.

(c) the coil moving in a constant magnetic field.

(d) the coil is stationary in external spatially varying magnetic field, which does not change with time.

5 Which of the following statements is not correct?

(a) Whenever the amount of magnetic flux linked with a circuit changes, an emf is induced in circuit.

(b) The induced emf lasts so long as the change in magnetic flux continues.

(c) The direction of induced emf is given by Lenz's law.

(d) Lenz's law is a consequence of the law of conservation of momentum

CHAPTER 7 - ALTERNATING CURRENT

MULTIPLE CHOICE QUESTIONS

1 In an LCR-series ac circuit, the voltage across each of the component L, C and R is 50 V. The voltage across the LC-combination will be

(a) 50 V (b) $50\sqrt{2}$ V (c) 100 V (d) zero

2 In an LCR circuit, capacitance is changed from C to 2C. For resonant frequency to remain unchanged, the inductance should be changed from L to

(a) 4 L (b) 2 L (c) L/2 (d) L/4

3 The core of any transformer is laminated so as to

(a) reduce the energy loss due to eddy currents. (b) make it light weight.

(c) make it robust and strong. (d) increase the secondary voltage.

4 If coil is open, then L and R becomes

(a) infinity, zero (b) zero, infinity

(c) infinity, infinity. (d) zero, zero

5 Which quantity is increased in a step-down transformer?

(a) Current (b) Voltage (c) Power (d) Frequency

6 A transformer is used to light a 100 W and 110 V lamp from 220 V mains. If the main current is 0.5 A, the efficiency of the transformer is approximately

(a) 30% (b) 50% (c) 90% (d) 10%

7 Choose the correct statement.

(a) A capacitor can conduct a dc circuit but not an inductor.

(b) In a dc circuit the inductor can conduct but not a capacitor.

(c) In dc circuit both the inductor and capacitor cannot conduct.

(d) The inductor has infinite resistance in a dc circuit.

8 What is the value of inductance L for which the current is maximum in a series LCR- circuit with C = 10 μF and ω = 1000 rad/s?

(a) 100 mH (b) 1 mH

(c) 10 mH (d) cannot be calculated unless R is known

9 A coil of self-inductance L is connected in series with a bulb B and an ac source. Brightness of the bulb decreases when

(a) frequency of the ac source is decreased.

(b) number of turns in the coil is reduced.

(c) a capacitance of reactance Xc = XL in included.

(d) an iron rod is inserted in the coil.

10 Reciprocal of impedance is

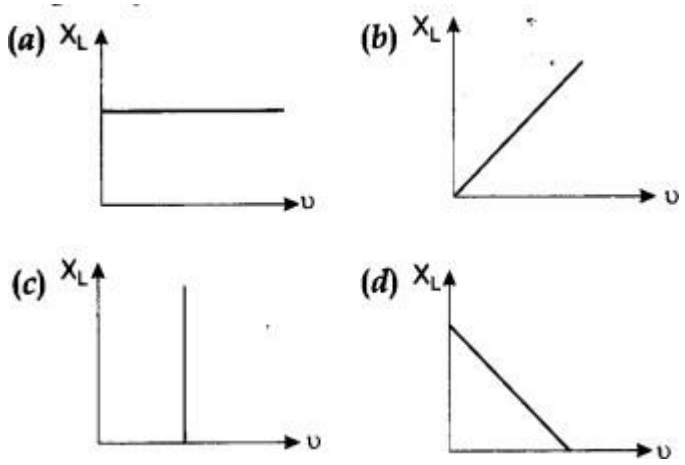
(a) susceptance (b) conductance (c) admittance (d) transconductance

11 In the case of an inductor

(a) voltage lags the current by π/2 (b) voltage leads the current by π/2

(c) voltage leads the current by π/3 (d) voltage leads the current by π/4

12 Which of the following graphs represents the correct variation of inductive reactance X_L with frequency u?



13 In a pure capacitive circuit if the frequency of ac source is doubled, then its capacitive reactance will be

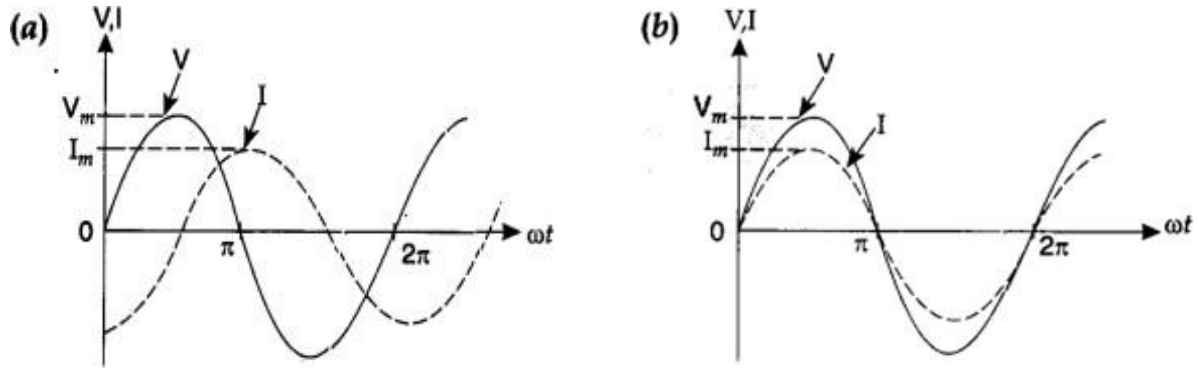
(a) remains same (b) doubled (c) halved (d) zero

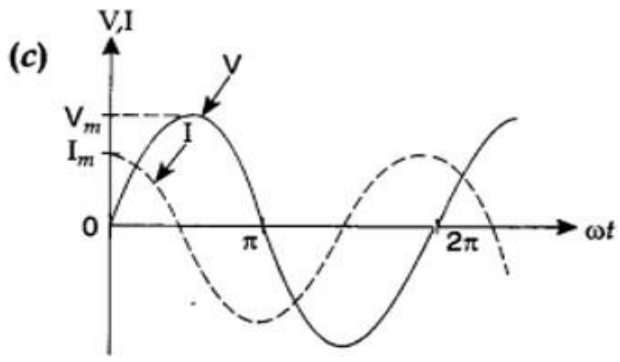
14 In series LCR circuit, the phase angle between supply voltage and current is

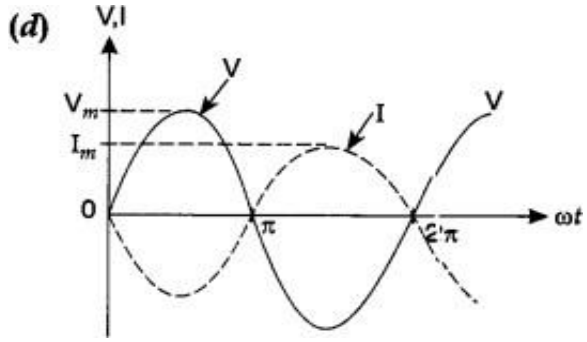
(a) $\tan\phi = \frac{X_L - X_C}{R}$ (b) $\tan\phi = \frac{R}{X_L - X_C}$

(c) $\tan\phi = \frac{R}{X_L + X_C}$ (d) $\tan\phi = \frac{X_L + X_C}{R}$

15 The phase relationship between current and voltage in a pure resistive circuit is best represented by







ASSERTION (A) & REASONING (R) QUESTIONS

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B - if both Assertion and Reason -- are true but Reason -- is not correct explanation of Assertion.

C - if Assertion is true but Reason -- is false.

D - if both Assertion and Reason -- are false.

1. Assertion- An AC doesn't show any magnetic effect
   Reason -- AC doesn't vary with time
2. Assertion- A variable capacitor is connected in series with a bulb through AC source if the capacitance of variable capacitor is decrease the brightness of bulb is reduced
   Reason -- The reactance of capacitor increase if capacitance is reduced
3. Assertion- A capacitor of suitable capacitance can be used in AC circuit in the place of choke coil
   Reason -- A capacitor blocks DC and allow only AC
4. Assertion- Average value of AC over a complete cycle is always zero
   Reason -- Average value of AC is always defined over half cycle
5. Assertion- Eddy current is produced in any metallic conductor when magnetic flux is changed around it
   Reason -- electric potential determine the flow of charge
6. Assertion- In LCR circuit resonance can take place
   Reason -- resonance can take place if inductance and capacitive reactance are equal and opposite
7. Assertion- When capacitive reactance is smaller than the inductive reactance in LCR circuit, emf leads the current
   Reason -- The phase angle is angle between alternating emf and alternating current of the circuit
8. Assertion- The DC and AC both can be measured by a hot wire instrument
   Reason -- The hot wire instrument is based on the principle of magnetic effect of current.

CASE STUDY BASED QUESTION

METAL DETECTOR

Metal detectors are useful for finding metal inclusions hidden within objects, or metal objects buried underground. They often consist of a handheld unit with a sensor probe which can be swept over the ground or other objects. Another common type are stationary "walk through" metal detectors. At an airport, a person is made to walk through the doorway of a metal detector, for security reasons. If she/he is carrying anything made of metal, the metal detector emits a sound. When you walk through a metal detector, you are, in fact, walking through a coil of many turns. The coil is connected to a capacitor tuned so that the circuit is in resonance. When you walk through with metal in your pocket, the impedance of the circuit changes – resulting in significant change in current in the circuit. This change in current is detected and the electronic circuitry causes a sound to be emitted as an alarm.

1. At resonance the impedance of the circuit is

   (a) Maximum (b). Minimum

   (c) Zero (d). Depends on the frequency of circuit

2. In an AC circuit consisting of a coil and a bulb how will the brightness of the bulb change if the frequency of source is increased.

   (a). No change (b) Increases

   (c) Decreases (d). First decreases then increases

3. In an ac circuit, the applied voltage and the current flowing are $E = 110 \sin \pi t$ and $I = 11 \sin (\pi t + \frac{\pi}{3})$ respectively. What is the power consumed in the circuit?

   (a). zero (b). 605W

   (c). $302.5W$ (d). $1210W$

4. Resonance in series LCR circuit is also used in tuning mechanism of TV sets. Which of the following combinations should be selected for better tuning of an L-C-R circuit used for communication?

   (a). R = 20 Ω, L = 1.5 H, C = 35μF (b). R = 25 Ω, L = 2.5 H, C = 45 μF

   (c). R=15Ω, L = 3.5H, C = 30 μF (d). R = 25 Ω, L = 1.5 H, C = 45 μf

5. As the frequency of an ac circuit increases, the current first increases and then decreases. What combination of circuit elements is most likely to comprise the circuit?

   (a) Only resistor. (b) Resistor and inductor.

   (c) Resistor and capacitor. (d) Resistor, inductor and capacitor.

ANSWERS

MULTIPLE CHOICE QUESTIONS

Q1	D	Q9	D
Q2	C	Q10	C
Q3	A	Q11	B
Q4	B	Q12	B
Q5	A	Q13	C
Q6	C	Q14	A
Q7	B	Q15	B
Q8	A		

ASSERTION AND REASONING QUESTIONS

Q1	D
Q2	A
Q3	B
Q4	B
Q5	B
Q6	A
Q7	B
Q8	C

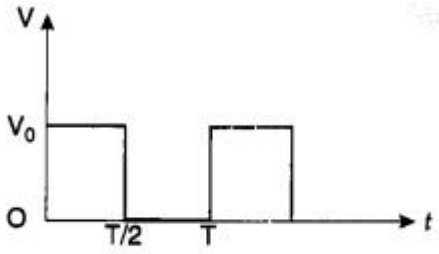
CASE STUDY BASED QUESTION

1.(b), 2.(c), 3.(c), 4.(c), 5.(d)

PRACTICE TEST PAPER

1. A transformer works on the principle of
   (a) converter.
   (b) inverter.
   (c) mutual inductance.
   (d) self-inductance.
2. Alternating current cannot be measured by dc ammeter, because
   (a) ac cannot pass through ac ammeter.
   (b) ac charges direction.
   (c) average value of current of complete cycle is zero.
   (d) ac ammeter will get damaged.

3. The rms value of potential difference V shown in the figure is

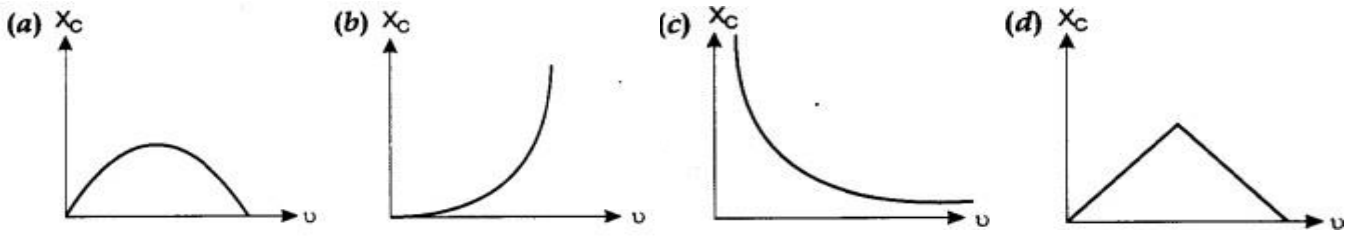


(a) $\frac{V_0}{\sqrt{3}}$ (b) V_0 (c) $\frac{V_0}{\sqrt{2}}$ (d) $\frac{V_0}{2}$

4. In a pure capacitive circuit if the frequency of ac source is doubled, then its capacitive reactance will be

(a) remains same (b) doubled (c) halved (d) zero

5. Which of the following graphs represents the correct variation of capacitive reactance Xc with frequency v u?



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8. Assertion: A capacitor of suitable capacitance can be used in AC circuit in the place of choke coil

Reason: A capacitor blocks DC and allow only AC

9. Assertion: An AC doesn't show any magnetic effect

Reason: AC varies with time

10. Assertion The division are equally marked on the scale of AC ammeter

Reason: heat produced is directly proportion to current