SAMPLE CONTENT


# CUET (UG)

## COMMON UNIVERSITY ENTRANCE TEST

• Based on notified • syllabus prescribed by NTA

**1601 MCQs**

**LOADED WITH AMAZING FEATURES**

- Caution
- Concept Videos
- Subtopic wise MCQs
- Topic Test
- Connections
- Smart Key/Thinking Hatke

# PHYSICS

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Target Publications® Pvt. Ltd.

**For Common University Entrance Test CUET (UG) based on syllabus prescribed by National Testing Agency (NTA)**

# CUET (UG)
# Physics

## Salient Features

- **'1601'** MCQs for ample practice
- Synopsis to offer a crisp overview of the chapter
- Subtopic wise segregation of MCQs for efficient practice
- Connections, Cautions designed to impart holistic learning
- A list of Important formulae provided via Q.R. code for quick revision
- Video links provided via Q.R codes for boosting conceptual retention
- Detailed solutions provided for better understanding
- Inclusion of Smart keys/Thinking Hatke to promote lateral thinking and problem-solving ability
- Topic Test provided for self-assessment at the end of each chapter
- Solution to Topic Test accessible via Q.R. code
- Includes Passage-based MCQs with Answers (Solution provided through Q.R. code)
- Includes relevant questions of CUCET 2021
- Includes Question Paper of CUET (UG) 2022–6th August (Slot - 2) (Solution provided through Q.R. Code)

Scan the adjacent QR code in *Quill - The Padhai App* to access the list of Important formulae segregated chapter-wise



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# PREFACE

Common University Entrance Test, CUET (UG) is a pivotal juncture in a student's academic journey. It is a single-window opportunity for the students to seek admission in the premier institutions for undergraduate courses after class XII.

Target Publications, with more than a decade of experience and expertise in the domain of competitive examination, offers **"CUET (UG) Physics"** for all the CUET (UG) aspirants. This book is compiled according to the notified syllabus prescribed by NTA for CUET (UG).

It is a complete preparation and practice book with the unmatched comprehensive amalgamation of theory, MCQs, and the tools that will be needed to clear the exam successfully.

The content of this book is arranged in a logical sequence to enable strategic learning. It provides the students with scientifically accurate context, several study techniques, and relevant supporting details essential for a better understanding of the concepts of Physics.

The chapter begins with '**Synopsis'** and is followed by '**Multiple Choice Questions'** (MCQs). The questions in the MCQs section are specially created and compiled to help students revise concepts as well as to give them practice of questions which require understanding of multiple-concepts. To aid students, detailed solutions are provided for difficult questions.

While ensuring the complete coverage of the syllabus in an effortless and easy to grasp format, emphasis is also given to optimize students learning outcomes. Keeping the following key objectives in mind:
Time management, easy memorization, revision, and non-conventional yet simple methods for MCQ solving, we have infused several features such as, **Caution, Connections, Smart Key and Thinking hatke**.

**Topic Test** is provided at the end of each chapter for self evaluation. Solution to Topic Test can be viewed by scanning the QR code provided at the end of each chapter.

A section of **Passage-based MCQs** covering a wide range of concepts is included at the end of the book. These passages are segregated chapter-wise and their solutions can be viewed though Q.R. code in a pdf format.

Question paper of CUET (UG) held on $6^{th}$ August (Slot - 2) 2022 is provided to offer students glimpse of the complexity of questions asked in entrance examination, solution to which is provided through Q.R. Code. The paper has been split topic wise to let the students know which of the topics were more relevant in the latest examination.
We are confident that this book will cater to the needs of students across varied backgrounds and effectively assist them to excel in the examination.

*We hope the book benefits the learner as we have envisioned.*

Publisher

**Edition:** Second

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you.

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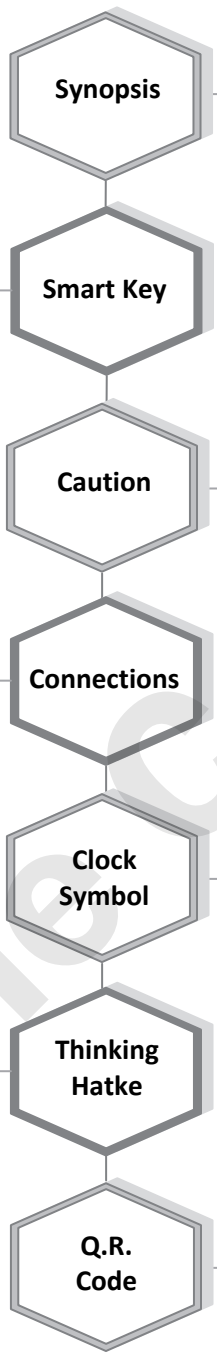
# KEY FEATURES




'**Synopsis**' presents crisp summary of a chapter in efficient form of pointers, tables, charts.

**'Smart Key'** comprises important theoretical or formula based short tricks which come handy while solving MCQ.

'**Caution**' apprises a student about commonly made mistakes.

'**Connections**' enable students to interlink concepts covered in different chapters.

'**Clock Symbol**' instructs students that the given MCQ can be solved apace by applying either smart keys or thinking hatke.

'**Thinking Hatke'** elucidates a simple non-conventional quick witted approach to arrive at the correct answer.

'**QR code**' provides:

i. Solution to Topic Test of each chapter.
ii. Access to the list of important formulae segregated chapter-wise, beneficial for last minute revision.
iii. Access to a video to boosts understanding of a concept or activity.
iv. Solutions to Passage-based MCQs.
v. Solution to CUET (UG) 2022 6$^{th}$ August (Slot - 2)

# CONTENTS



**Note:** Symbol indicates the question can either be solved by applying a '**Smart Key'** or by '**Thinking Hatke'**

'**Caution**' makes students watchful against commonly made mistakes

'**Connections'** interlink concepts covered in different chapters

## Broad features of CUET (UG)

| **Mode of Examination:** Computer Based Test (CBT) mode | | | | | | |
|---|---|---|---|---|---|---|
| **Sections** | **Subjects/ Tests** | **Questions to be Attempted** | **Marks per Question** | **Total Marks** | **Question Type** | **Duration** |
| **Section IA - Languages** | There are 13 different languages. Any of these languages may be chosen. | 40 questions out of 50 in each language | 5 | 200 | • Language to be tested through Reading Comprehension based on different types of passages–Factual, Literary and Narrative, [Literary Aptitude and Vocabulary]<br>• MCQ Based Questions | 45 Minutes for each language |
| **Section IB - Languages** | There are 20 Languages. Any other language apart from those offered in Section I A may be chosen. | | | | | |
| **Section II - Domain** | There are 27 Domains specific Subjects being offered under this Section. A candidate may choose a maximum of Six Domains as desired by the applicable University/ Universities. | 40 questions out of 50 in each subject | 5 | 200 | • Input text can be used for MCQ Based Questions<br>• MCQs based on syllabus given on NTA website | 45 Minutes for each Domain Specific Subjects |
| **Section III General Test** | For any such undergraduate programme/ programmes being offered by Universities where a General Test is being used for admission. | 60 questions out of 75 | 5 | 300 | • Input text can be used for MCQ Based Questions<br>• General Knowledge, Current Affairs, General Mental Ability, Numerical Ability, Quantitative Reasoning (Simple application of basic mathematical arithmetic/algebra geometry/mensuration /stat taught till Grade 8), Logical and Analytical Reasoning | 60 Minutes |
| **Note:**<br>• One mark will be deducted for a wrong answer.<br>• Unanswered/Marked for Review will be given no mark (0). | | | | | | |

*Candidates are advised to visit the NTA CUET (UG) official website* ***https://cuet.samarth.ac.in/*** *for latest updates regarding the Examination.*

# How This Book Covers The Entire Syllabus of CUET (UG) Physics

| CUET (UG) Syllabus | Chapter no. | Subtopic no. | Subtopic name |
|---|---|---|---|
| **UNIT I: Electrostatics** | | | |
| Electric charges and their conservation | 1 | 1.2 | Electric charge |
| Coulomb's law – force between two point charges | 1 | 1.6 | Coulomb's law |
| Forces between multiple charges; superposition principle | 1 | 1.7 | Forces between multiple charges |
| Continuous charge distribution | 1 | 1.13 | Continuous charge distribution |
| Electric field, electric field due to a point charge | 1 | 1.8 | Electric field |
| Electric field lines | 1 | 1.9 | Electric field lines |
| Electric dipole, electric field due to a dipole | 1 | 1.11 | Electric dipole |
| Torque on a dipole in a uniform electric field | 1 | 1.12 | Dipole in a uniform external field |
| Electric flux | 1 | 1.10 | Electric flux |
| Statement of Gauss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet, and uniformly charged thin spherical shell (field inside and outside) | 1 | 1.14, 1.15 | Gauss's law, Applications of Gauss's law |
| Electric potential, potential difference | 2 | 2.2 | Electrostatic potential |
| Electric potential due to a point charge, a dipole and system of charges | 2 | 2.3, 2.4, 2.5 | Potential due to a point charge, Potential due to an electric dipole, Potential due to a system of charges |
| Equipotential surfaces | 2 | 2.6 | Equipotential surfaces |
| The electrical potential energy of a system of two point charges, and electric dipoles in an electrostatic field | 2 | 2.7, 2.8 | Potential energy of a system of charges, Potential energy in an external field |
| Conductors and insulators, free charges, and bound charges inside a conductor | 1 | 1.3 | Conductors and insulators |
| Dielectrics and electric polarization | 2 | 2.10 | Dielectrics and polarisation |
| Capacitors and capacitance | 2 | 2.11 | Capacitors and capacitance |
| The combination of capacitors in series and in parallel | 2 | 2.14 | Combination of capacitors |
| The capacitance of a parallel plate capacitor with and without dielectric medium between the plates | 2 | 2.12, 2.13 | The parallel plate capacitor, Effect of dielectric on capacitance |
| Energy stored in a capacitor | 2 | 2.15 | Energy stored in a capacitor |
| Van de Graaff generator | 2 | 2.16 | Van de Graaff generator |
| **UNIT II: Current Electricity** | | | |
| Electric current | 3 | 3.2 | Electric current |
| The flow of electric charges in a metallic conductor, drift velocity and mobility, and their relation with electric current | 3 | 3.3 | Electric currents in conductors |
| Ohm's law, electrical resistance, V-I characteristics (linear and non-linear) | 3 | 3.4,3.5,3.6 | Ohm's Law, Drift of electrons and the origin of resistivity, Limitations of ohm's law |

| CUET (UG) Syllabus | Chapter no. | Subtopic no. | Subtopic name |
|---|---|---|---|
| Electrical energy and power | 3 | 3.9 | Electrical energy, power |
| Electrical resistivity and conductivity | | | |
| Carbon resistors, colour code for carbon resistors | 3 | 3.7 | Resistivity of various materials |
| Series and parallel combinations of resistors | 3 | 3.10 | Combination of resistors- series and parallel |
| Temperature dependence of resistance | 3 | 3.8 | Temperature dependence of resistivity |
| The internal resistance of a cell, potential difference, and emf of a cell | 3 | 3.11 | Cells, emf, internal resistance |
| combination of cells in series and in parallel | 3 | 3.12 | Cells in series and in parallel |
| Kirchhoff 's laws and simple applications | 3 | 3.13 | Kirchhoff's rules |
| Wheatstone bridge | 3 | 3.14 | Wheatstone bridge |
| Metre bridge | 3 | 3.15 | Meter bridge |
| Potentiometer – principle, and applications to measure potential difference, and for comparing emf of two cells; measurement of internal resistance of a cell | 3 | 3.16 | Potentiometer |
| **UNIT III: Magnetic Effects of Current and Magnetism** | | | |
| Concept of the magnetic field, Oersted's experiment | 4 | 4.1 | Intoduction |
| Biot - Savart law and its application to current carrying circular loop | 4 | 4.5 | Magnetic field due to a current element, Biot-Savart law |
| Ampere's law and its applications to infinitely long straight wire, straight and toroidal solenoids | 4 | 4.7, 4.8 | Ampere's circuital law, The solenoid and the toroid |
| Force on a moving charge in uniform magnetic and electric fields. Cyclotron | 4 | 4.3, 4.4 | Motion in a magnetic field, Motion in combined electric and magnetic field |
| Force on a current-carrying conductor in a uniform magnetic field. The force between two parallel current-carrying conductors – definition of ampere | 4 | 4.9 | Force between two parallel currents, the ampere |
| Torque experienced by a current loop in a magnetic field; moving coil galvanometer – its current sensitivity and conversion to ammeter and voltmeter | 4 | 4.10, 4.11 | Torque on current loop, magnetic dipole, The moving coil galvanometer |
| Current loop as a magnetic dipole and its magnetic dipole moment. The magnetic dipole moment of a revolving electron. Magnetic field intensity due to a magnetic dipole (bar magnet) along its axis and perpendicular to its axis. | 4 | 4.10 | Torque on current loop magnetic dipole |
| Torque on a magnetic dipole (bar magnet) in a uniform magnetic field; bar magnet as an equivalent solenoid, magnetic field lines; | 5 | 5.2 | The bar magnet |
| Earth's magnetic field and magnetic elements | 5 | 5.4, 5.5 | The earth's magnetism, Magnetisation and magnetic intensity |
| Para-, dia- and ferromagnetic substances, with examples. Electromagnets and factors affecting their strengths. Permanent magnets | 5 | 5.6, 5.7 | Magnetic properties of materials, permanent magnets and electromagnets |

| CUET (UG) Syllabus | Chapter no. | Subtopic no. | Subtopic name |
|---|---|---|---|
| **UNIT IV: Electromagnetic Induction and Alternating Currents** | | | |
| Electromagnetic induction; Faraday's law, induced emf and current | 6 | 6.2, 6.3, 6.4 | The experiments of Faraday and Henry, Magnetic flux, Faraday's law of induction |
| Lenz's Law | 6 | 6.5 | Lenz's law and conservation of energy |
| Eddy currents | 6 | 6.8 | Eddy currents |
| Self and mutual inductance | 6 | 6.9 | Inductance |
| Alternating currents, Peak and rms value of alternating current/voltage, Reactance and impedance | 7 | 7.1, 7.2, 7.4, 7.5, 7.6 | Introduction, AC voltage applied to a resistor, AC voltage applied to an inductor, AC voltage applied to a capacitor, AC voltage applied to a series LCR circuit |
| LC oscillations (qualitative treatment only) | 7 | 7.8 | LC oscillations |
| LCR series circuit | 7 | 7.6 | AC voltage applied to a series LCR circuit |
| Resonance, Power in AC circuits, wattless current | 7 | 7.7 | Power in AC circuit: The power factor |
| AC generator | 6 | 6.10 | AC generator |
| Transformer | 7 | 7.9 | Transformers |
| **UNIT V: Electromagnetic Waves** | | | |
| Need for displacement current. | 8 | 8.2 | Displacement current |
| Electromagnetic waves and their characteristics (qualitative ideas only). Transverse nature of electromagnetic waves | 8 | 8.3 | Electromagnetic waves |
| Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays) including elementary facts about their uses. | 8 | 8.4 | Electromagnetic spectrum |
| **UNIT VI: Optics** | | | |
| Reflection of light, spherical mirrors, mirror formula | 9 | 9.2 | Reflection of light by spherical mirrors |
| Refraction of light | 9 | 9.3 | Refraction |
| total internal reflection and its applications, optical fibres | 9 | 9.4 | Total internal reflection |
| refraction at spherical surfaces, lenses, thin lens formula, lens maker's formula, Magnification, power of a lens, combination of thin lenses in contact combination of a lens and a mirror | 9 | 9.5 | Refraction at spherical surfaces and by lenses |
| Refraction and dispersion of light through a prism | 9 | 9.6 | Refraction through a prism |
| Scattering of light–blue colour of the sky and reddish appearance of the sun at sunrise and sunset | 9 | 9.7 | Some natural phenomena due to sunlight |
| Optical instruments: Human eye, image formation, and accommodation, correction of eye defects (myopia and hypermetropia) using lenses. Microscopes and astronomical telescopes (reflecting and refracting) and their magnifying powers | 9 | 9.8 | Optical instruments |

| CUET (UG) Syllabus | Chapter no. | Subtopic no. | Subtopic name |
|---|---|---|---|
| Wave optics: Wavefront and Huygens' principle, | 10 | 10.2 | Huygens principle |
| Reflection, and refraction of plane wave at a plane surface using wavefronts, Proof of laws of reflection and refraction using Huygens' principle | 10 | 10.3 | Refraction and Reflection of plane waves using Huygens principle |
| Interference, Young's double hole experiment and expression for fringe width | 10 | 10.5 | Interference of light waves and young's experiment |
| Coherent sources, and sustained interference of light | 10 | 10.4 | Coherent and Incoherent addition of waves |
| Diffraction due to a single slit, width of central maximum, Resolving the power of microscopes and astronomical telescopes | 10 | 10.6 | Diffraction |
| Polarisation, plane polarised light; Brewster's law, uses of plane polarised light and Polaroids | 10 | 10.7 | Polarisation |
| **UNIT VII: Dual Nature of Matter and Radiation** | | | |
| Photoelectric effect | 11 | 11.3 | Photoelectric effect |
| Hertz and Lenard's observations | 11 | 11.4 | Experimental study of photoelectric effect |
| Einstein's photoelectric equation – particle nature of light | 11 | 11.6, 11.7 | Einstein's photoelectric equation: energy quantum of radiation, Particle nature of light: the photon |
| Matter waves – wave nature of particles, de Broglie relation | 11 | 11.8 | Wave nature of matter |
| Davisson-Germer experiment (experimental details should be omitted; only the conclusion should be explained.) | 11 | 11.9 | Davisson and Germer experiment |
| **UNIT VIII: Atoms and Nuclei** | | | |
| Alpha - particle scattering experiment, Rutherford's model of atom | 12 | 12.1 | Alpha-particle Scattering and Rutherford's Nuclear Model of Atom |
| Bohr model, Energy levels | 12 | 12.3 | Bohr Model of the Hydrogen Atom and Energy Levels |
| Hydrogen spectrum | 12 | 12.2 | Hydrogen Spectrum |
| Composition and size of nucleus | 13 | 13.1, 13.2 | Atomic Masses and Composition of Nucleus, Size of the Nucleus |
| Atomic masses, isotopes, isobars, isotones | 13 | 13.1 | Atomic Masses and Composition of Nucleus |
| Radioactivity – alpha, beta, and gamma particles/rays, and their properties, Radioactive decay law | 13 | 13.4 | Radioactivity and Radioactive Decay Law |
| Mass-energy relation, mass defect, Binding energy per nucleon and its variation with mass number | 13 | 13.3 | Mass-Energy Relation and Binding Energy per Nucleon |
| Nuclear fission and fusion | 13 | 13.5 | Nuclear Fission and Fusion |

| CUET (UG) Syllabus | Chapter no. | Subtopic no. | Subtopic name |
|---|---|---|---|
| **UNIT IX: Electronic Devices** | | | |
| Energy bands in solids (qualitative ideas only), conductors, insulators, and semiconductors | 14 | 14.2, 14.3, 14.4 | Classification of metals, conductors and Semiconductors, Intrinsic semiconductor, Extrinsic semiconductor |
| semiconductor diode – *I-V* characteristics in forward and reverse bias | 14 | 14.5, 14.6 | p-n junction, Semiconductor diode |
| diode as a rectifier | 14 | 14.7 | Application of junction diode as a rectifier |
| *I-V* characteristics of LED, photodiode, solar cell, and Zener diode; Zener diode as a voltage regulator | 14 | 14.8 | Special purpose p-n junction diodes |
| Junction transistor, transistor action, characteristics of a transistor; transistor as an amplifier (common emitter configuration) and oscillator | 14 | 14.9 | Bipolar junction transistor |
| Logic gates (OR, AND, NOT, NAND and NOR) | 14 | 14.10 | Digital electronics and logic gates |
| Transistor as a switch | 14 | 14.9 | Bipolar junction transistor |
| **UNIT X: Communication Systems** | | | |
| Elements of a communication system (block diagram only) | 15 | 15.1 | Elements of a communication system |
| bandwidth of signals (speech, TV, and digital data), bandwidth of transmission medium | 15 | 15.2 | Bandwidth of signals (Bandwidth of transmission medium) |
| Propagation of electromagnetic waves in the atmosphere, sky, and space wave propagation | 15 | 15.3 | Propagation of electromagnetic waves in the atmosphere, sky and space wave propagation |
| Need for modulation | 15 | 15.4 | Need for modulation |
| Production and detection of an amplitude-modulated wave | 15 | 15.5 | Production and detection of an amplitude-modulated wave |

**Note:** This book covers a few subtopics in addition to the syllabus prescribed by NTA to help students have thorough and complete understanding of the concepts.

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To see complete chapter buy **Target Notes** or **Target E-Notes**

# 06 Electromagnetic Induction

**Content and Concepts**



**Synopsis**

**Electromagnetic Induction**

**Faraday's laws of E.M.I.**

**First law:**
Whenever there is a change in the magnetic flux associated with a coil, an e.m.f is induced in the coil.
**Second law:**
The magnitude of the induced e.m.f is directly proportional to the rate of change of magnetic flux through the coil.

**Lenz's law**

The direction of induced current in a circuit is such that the magnetic field produced by the induced current opposes the change in the magnetic flux that induces the current. The direction of induced emf is same as that of induced current.

**Eddy currents**

The circulating currents induced in a metal block, when it is placed or moved in a changing magnetic field are called eddy currents.

*Students can scan the adjacent QR code to get demonstration of **eddy current** with the aid of a linked video.*

**Smart Key - 1**

i. Induced charge,

$$dq = idt = \frac{e\,dt}{R} = \frac{N d\phi}{R} = \frac{N(\phi_2 - \phi_1)}{R}$$

Induced charge is independent of time.

ii. Power,

$$P = \text{induced e.m.f} \times \text{induced current} = ei = \frac{e^2}{R} = i^2R = \frac{N^2}{R}\left(\frac{d\phi}{dt}\right)^2$$

iii. Work = Power × time = $eidt = i\,d\phi$

**Motional electromagnetic force**

**Translational motion of a conductor**

Maximum induced emf, $e_{max} = Blv$

**Motional emf in a rotating bar**

Total induced emf in rotating rod

$$e = \frac{1}{2} B\omega l^2$$

**Smart Key - 2**

i. If a metallic rod of length $l$ rotates about one of its ends in a plane perpendicular to the magnetic field, then the induced e.m.f produced across its ends is given by, $e = \frac{B\omega l^2}{2} = Bl^2\pi\nu = BA\nu$

Here, $\omega = 2\pi\nu$ = angular frequency of rotation, $A = \pi l^2$ = area of circle, $\nu$ = frequency of rotation.

ii. Similarly, for a metallic disc rotating about its own centre, the induced e.m.f. produced between centre and the edge is given by, $e = \frac{B\omega r^2}{2} = BA\nu$

**Induction**

**Self Inductance (L)**

- Self-inductance of a circuit is the ratio of induced emf (caused by changing current in the circuit) produced around the circuit to the rate of change of current in it.

**Inductance in series**

$L_{Total} = L_1 + L_2 + L_3 + \ldots$

**Inductance in parallel**

$$\frac{1}{L_{Total}} = \frac{1}{L_1} + \frac{1}{L_2} + \frac{1}{L_3} + \ldots.$$

**Mutual inductance (M)**

- Mutual inductance is defined as the value of induced emf produced in the secondary circuit per unit rate of change in current in the primary circuit.

**Inductance in series**

$L = L_1 + L_2 \pm 2M$

**Inductance in parallel**

$$L_P = \frac{L_1L_2 - M^2}{L_1 + L_2 \pm 2M}$$

**⚠ CAUTION**

For mutual inductance of two coils connected in series, (+) sign is taken when current in the two coils is in the same direction and (–) sign when the current is in opposite direction.

## Smart Key - 3

**i. Formulae of self inductance for different shapes:**

| Sr. no. | Condition |
|---|---|
| a. | **Circular coil,** $L = \frac{\mu_0 \pi N^2 r}{2}$ |
| b. | **Square coil,** $L = \frac{2\sqrt{2}\mu_0 N^2 a}{\pi}$ |
| c. | **Toroid,** $L = \frac{\mu_0 N^2 r}{2}$ |
| d. | **Solenoid,** $L = \frac{\mu_0 N^2 A}{l}$<br>If core is of any other magnetic material then<br>$L = \frac{\mu N^2 A}{l}$ $\ldots.(\mu = \mu_0\mu_r)$ |
| e. | **Coaxial cylinders,**<br>$L = \frac{\mu_0}{2\pi r}\log_e\frac{R}{r} = \frac{2.303}{2\pi r}\mu_0 \log_{10}\frac{R}{r}$ |

**ii. Formulae of mutual inductance for different shapes:**

| Sr. No. | Condition |
|---|---|
| a. | **Two concentric coplanar circular coils,**<br>$M = \frac{\pi\mu_0 N_1 N_2 r^2}{2R}$ |
| b. | **Two concentric coplanar square coils,**<br>$M = \frac{\mu_0 2\sqrt{2} N_1 N_2 l^2}{\pi L}$ |
| c. | **Two Solenoids,** $M = \frac{\mu_0 N_1 N_2 A}{l}$ |

## Multiple Choice Questions

### 6.2 The experiments of Faraday and Henry

1. If a magnet is moved towards a coil, the magnitude of induced e.m.f in the coil depends upon _____.
   (A) length of the magnet
   (B) breadth of the magnet
   (C) velocity of the magnet
   (D) density of the magnet

2. A magnet is brought towards a coil (i) speedly (ii) slowly then the induced e.m.f./induced charge will be respectively
   (A) More in first case / More in first case
   (B) More in first case/Equal in both case
   (C) Less in first case/More in second case
   (D) Less in first case/Equal in both case

3. Two identical circular metal coils A and B are kept on a table in such a way that they are very close, but they do not touch each other. The coil A carries a current and it is slowly increased. What is the response of the coil B?
   (A) B is attracted by A.
   (B) B is repelled by A.
   (C) B is not affected.
   (D) B is first attracted by A and then repelled.

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To see complete chapter buy **Target Notes** or **Target E-Notes**

2. Which of the following statement is incorrect?
   (A) Both a.c. and d.c. dynamo have a field magnet.
   (B) Both a.c. and d.c. dynamo have an armature.
   (C) Both a.c. and d.c. dynamo convert mechanical energy into electrical energy.
   (D) Both a.c. and d.c. dynamo have slip rings.

3. The output of a dynamo using a splitting commutator is _____.
   (A) d.c.
   (B) a.c.
   (C) fluctuating d.c.
   (D) half-wave rectified voltage

4. The number of turns in the coil of an A.C. generator are 100 and its cross-sectional area is 2.5 $m^2$. The coil is revolving in a uniform magnetic field of strength 0.3 T with the uniform angular velocity of 60 rad/s. The value of maximum voltage produced is _____ kV.
   (A) 1.25 (B) 4.50
   (C) 6.75 (D) 2.25

5. The number of turns in the coil of an a.c. generator is 5000 and the area of the coil is 0.25 $m^2$. The coil is rotated at the rate of 100 cycles/s in a magnetic field of 0.2 $Wb/m^2$. The peak value of the emf generated is nearly
   (A) 786 kV (B) 440 kV
   (C) 220 kV (D) 157.1 kV

## Answers to MCQs

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **6.2 :** | 1. (C) | 2. (B) | 3. (B) | | | | | | | | | | | | | | | | |
| **6.3 :** | 1. (A) | 2. (A) | 3. (D) | 4. (A) | 5. (A) | | | | | | | | | | | | | | |
| **6.4 :** | 1. (B) | 2. (A) | 3. (D) | 4. (D) | 5. (D) | 6. (D) | 7. (D) | 8. (B) | 9. (C) | 10. (C) | 11. (D) | | | | | | | | |
| **6.5 :** | 1. (D) | 2. (B) | 3. (B) | 4. (B) | | | | | | | | | | | | | | | |
| **6.6 :** | 1. (A) | 2. (B) | 3. (A) | 4. (C) | 5. (C) | 6. (B) | | | | | | | | | | | | | |
| **6.8 :** | 1. (D) | 2. (C) | 3. (B) | 4. (B) | 5. (B) | | | | | | | | | | | | | | |
| **6.9 :** | 1. (D) | 2. (B) | 3. (B) | 4. (B) | 5. (A) | 6. (A) | 7. (D) | 8. (A) | 9. (C) | 10. (D) | 11. (C) | 12. (B) | | | | | | | |
| **6.10 :** | 1. (A) | 2. (D) | 3. (C) | 4. (B) | 5. (D) | | | | | | | | | | | | | | |

## Solutions to MCQs

### 6.2 The experiments of Faraday and Henry

**1. (C)**

**2. (B)**
The magnitude of induced e.m.f is directly proportional to the rate of change of magnetic flux.
Using ***Smart Key - 1(i),***
Induced charge doesn't depend upon time. So, whether the magnet moves rapid or slow, induced charge will remain the same.

**3. (B)**

### 6.3 Magnetic flux

**1. (A)**

**2. (A)**
$\phi = \vec{B} \cdot \vec{A}$. The area vector $\vec{A}$ is perpendicular to the surface. So, when the surface is parallel to the magnetic field, the angle between $\vec{B}$ and $\vec{A}$ is 90°. Hence $\phi = 0$

**3. (D)**

**4. (A)**
$\phi = BA = 10^3 \times 10^{-2} = 10$ weber

**5. (A)**
$\phi = NBA\cos\theta = 100 \times 0.2 \times 5 \times 10^{-4} \cos 60°$
$= 5 \times 10^{-3}$ Wb

## 6.4 Faraday's law of induction

**1. (B)**

**2. (A)**
Faraday's laws involve conversion of mechanical energy into electric energy. This is in accordance with the law of conservation of energy.

**3. (D)**
Whenever magnetic flux linked with a circuit changes, induced e.m.f. is produced and e.m.f. lasts as long as the change in the magnetic flux continues.

**4. (D)**
As the electron approaches the coil, the current develops in the coil to oppose the change in its magnetic flux. But when electron moves away, then the magnetic field inside the loop decreases and current changes its direction.

**5. (D)**
Induced e.m.f = rate of change of magnetic flux

$$= \frac{0.8}{0.2} = 4 \text{ V}$$

**6. (D)**

$$e = -NA\frac{dB}{dt} = -500 \times 0.15\left[\frac{0.2-1}{0.4}\right] = 150 \text{ V}$$

**7. (D)**

$$|e| = N\left(\frac{\Delta B}{\Delta t}\right) A\cos\theta$$

$$= 1000 \times 1 \times (20 \times 10^{-2})^2 \cos 0 = 40 \text{ V}$$

**8. (B)**

$$e = -\frac{NBA(\cos\theta_2 - \cos\theta_1)}{\Delta t}$$

$$= -2000 \times 0.3 \times 70 \times 10^{-4}\ \frac{(\cos 180 - \cos 0)}{0.1}$$

$\therefore$ e = 84 V

**9. (C)**
The magnitude of induced emf is given by

$$|e| = \frac{d\phi_B}{dt} = \frac{d}{dt}(5t^2 + 3t + 16)$$

$$= 10t + 3 + 0 = 10t + 3$$

At t = 4 s,

$|e| = 10 \times 4 + 3 = 43$ V

**10. (C)**

$\phi_1 = 4 \times 10^{-4}$Wb

$\phi_2 = 0.1\ \phi_1 = 0.4 \times 10^{-4}$Wb

$\therefore$ $d\phi = |\phi_2 - \phi_1| = 3.6 \times 10^{-4}$Wb

dt = t second

$$e = \frac{d\phi}{dt}$$

$$\therefore \quad 0.72 \times 10^{-3} = \frac{3.6 \times 10^{-4}}{t}$$

$$\therefore \quad t = \frac{3.6 \times 10^{-4}}{0.72 \times 10^{-3}}$$

t = 0.5 second

**11. (D)**

$$\frac{dB}{dt} = 10^8 \text{ gauss/s} = 10^4 \text{ T/s}$$

$$I = \frac{e}{R} = \frac{NA(dB/dt)}{R} = \frac{10 \times 10^{-3} \times 10^4}{20} = 5 \text{ A}$$

## 6.5 Lenz's law and conservation of energy

**1. (D)**
The energy of the field increases with the magnitude of the field. Lenz's law infers that there is an opposite field created due to increase or decrease of magnetic flux around a conductor so as to hold the law of conservation of energy.

**2. (B)** **3. (B)** **4. (B)**

## 6.6 Motional electromotive force

**1. (A)**

**2. (B)**

$e = Bvl = 10^{-3} \times 10^2 \times 3 = 0.3$ volt

**3. (A)**

$$v = 1080 \text{ km/hr} = 1080 \times \frac{5}{18} \text{ m/s} = 300 \text{ m/s}$$

e.m.f developed between the tips of the wing is,

$e = Blv = 1.75 \times 10^{-5} \times 40 \times 300 = 0.21$ V

**4. (C)**

$|e| = Blv$

$$\therefore \quad B = \frac{e}{lv} = \frac{2}{0.5 \times \frac{300}{60}} = 0.8 \text{ tesla}$$

**5. (C)**
Using ***Smart Key – 2,***

$$e = \frac{1}{2}Bl^2\omega = Bl^2\pi\nu$$

$\therefore$ $e = 0.5\ (20 \times 10^{-2})^2 \times 3.14 \times 100 = 6.28$ V

**6. (B)**
Refer ***Smart Key - 2(ii)***

**⚠ CAUTION**

The induced emf is independent of numbers of spokes in the wheel.

## 6.8 Eddy currents

**1. (D)** **2. (C)** **3. (B)**

**4. (B)**
When a metallic plate with slots cut in is made to oscillate in the magnetic field, there is damping effect but it is small compared to the case when no slots were cut. Eddy currents are considerably reduced by taking plate with slots and consequently less damping.

**5. (B)**

## 6.9 Inductance

**1. (D)**

$e = L\dfrac{dI}{dt}$

$L = \dfrac{e}{(dI/dt)}$

**2. (B)**

Using ***Smart Key - 3(i - a) and (i - c),***

For circular coil, $L_1 = \dfrac{\mu_0 \pi N^2 r}{2}$

For toroid, $L_2 = \dfrac{\mu_0 N^2 r}{2}$

$\therefore \quad \dfrac{L_1}{L_2} = \pi$

**3. (B)**

**4. (B)**

Given: N = 1000; I = 4A; $\phi = 4 \times 10^{-3}$ Wb.

$\therefore$ Total magnetic flux linked with solenoid = $N\phi$

Self inductance, $L = \dfrac{N\phi}{I}$ $\quad \ldots.(\because \phi = LI)$

$\therefore \quad L = \dfrac{1000 \times 4 \times 10^{-3}}{4} = 1$ H

**5. (A)**

Using ***Smart Key - 3(i - a),***

$\therefore \quad L = \dfrac{\mu_0 N^2 \pi r}{2}$

$L = \dfrac{4\pi \times 10^{-7} \times 500 \times 500 \times \pi \times 0.05}{2} = 25$ mH

**6. (A)**

Using ***Smart Key - 3 (ii - a),***

$M = \dfrac{\pi \mu_0 N_1 N_2 r^2}{2R}$

Here $N_1 = N_2 = 1$, $r = r_2$, $R = r_1$

$M = \dfrac{\mu_0 \pi r_2^2}{2r_1}$

**7. (D)**

$e = M\left|\dfrac{dI}{dt}\right| = 1.25 \times 80 = 100$ V

**8. (A)**

$e_2 = M\dfrac{dI_1}{dt} \Rightarrow I_2 R_2 = M\dfrac{dI_1}{dt}$

$\Rightarrow 0.4 \times 5 = 0.5 \times \dfrac{dI_1}{dt} \Rightarrow \dfrac{dI_1}{dt} = 4$ A/s.

**9. (C)**

$\phi = MI \Rightarrow M = \dfrac{1.2 \times 10^{-2}}{0.01} = 1.2$ H

**10. (D)**

$e_2 = M\dfrac{dI_1}{dt} = 6 \times \left|\dfrac{(2-2)}{10^{-3}}\right| = 0$ V

**THINKING HATKE – Q. 10**

In secondary coil, e.m.f. induces only when current through primary changes.

**11. (C)**

Using ***Smart Key - 3 (ii - a),***

$M = \dfrac{\mu_0 N_1 N_2 \pi r_1^2}{2r_2}$

$= \dfrac{4\pi \times 10^{-7} \times 100 \times 1000\pi (0.02)^2}{2 \times 0.2}$

$= 39.44 \times 10^{-5}$ H

$e = M\left|\dfrac{dI}{dt}\right| = 39.44 \times 10^{-5} \dfrac{(7-5)}{4 \times 10^{-2}}$ volt

$\therefore \quad e = 19.72 \times 10^{-3}$ V = 19.72 mV

**12. (B)**

Using ***Smart Key - 3 (ii - c),***

$M = \dfrac{\mu_0 N_p N_S A_2}{l}$

$M = \dfrac{(4\pi \times 10^{-7}) \times 2000 \times 300 \times (1.2 \times 10^{-3})}{0.30}$

$e = M\dfrac{dI}{dt}$

$\therefore \quad e = \dfrac{(4\pi \times 10^{-7}) \times 2000 \times 300 \times (1.2 \times 10^{-3})}{0.30} \times \dfrac{4}{0.25}$

$\therefore \quad e = 4.8 \times 10^{-2}$ volt

## 6.10 AC generator

**1. (A)**

Rotation of magnet in the dynamo creates the variable flux which in turn produces the induced current.

**2. (D)**

Only a.c. dynamo has slip rings.

**3. (C)**

Commutator converts a.c. into fluctuating dc.

**4. (B)**

Induced emf $e = NBA\omega \sin \omega t$

For maximum value of voltage or emf,

$\sin \omega t = 1$

$\therefore \quad e_0 = NBA\omega$

$= 100 \times 0.3 \times 2.5 \times 60$

$= 4500 = 4.5 \times 10^3$ volt = 4.5 kV

**5. (D)**

$e_0 = \omega NBA = (2\pi\nu)NBA$

$= 2 \times 3.14 \times 100 \times 5000 \times 0.2 \times 0.25$

$= 157$ kV

## Topic Test

1. Mutual induction is the production of induced e.m.f. in a coil due to changes of current in the
   (A) neighbouring coil.
   (B) same coil.
   (C) both (A) and (B).
   (D) neither (A) nor (B)

2. The self inductance of a inductive coil is 0.4 H. The current in the coil is decreasing at the rate of 2 A per second. What is the e.m.f induced in the coil?
   (A) 4.8 V (B) 1.8 V
   (C) 1.6 V (D) 0.8 V

3. Current passing through a coil is changing at the rate of 1.5 ampere per second. If it induces e.m.f of 45 volt, then self inductance of the coil will be
   (A) 30 H (B) 67.5 H
   (C) 60 H (D) 33.3 H

4. Self-inductance of a solenoid depends on
   (A) the number of turns N of the coil only.
   (B) the area of cross-section A and length $l$ of the coil only.
   (C) the permeability of the core of the coil only.
   (D) the number of turns, the area of cross section, length of the coil and permeability of the core of the coil.

5. The magnetic field linked with a coil changes from 1 weber to 0.1 weber in 0.1 second. The e.m.f induced will be
   (A) 9 V (B) 10 V
   (C) 0.009 V (D) 1/9 V

6. Self-inductance of two identical coils is 0.1 H. They are wound over each other. Mutual inductance will be
   (A) 0.1 H (B) 0.2 H
   (C) 0.001 H (D) 0.05 H

7. If the flux associated with a coil changes at the rate of 240 weber in every 2 minutes, then the induced e.m.f. is
   (A) 2 volt (B) 0.20 volt
   (C) 3 volt (D) 6 volt

8. Eddy currents are also known as _____ currents.
   (A) alternating (B) focault
   (C) direct (D) peak

9. A current through a choke coil of self inductance 2 H decreases at the rate of 0.5 A/s. The e.m.f. developed across the coil is
   (A) 1.0 V (B) 0.5 V (C) 2.0 V (D) 3.0 V

10. A varying current in a coil changes from 10 A to zero in 0.5 s. If the average e.m.f induced in the coil is 220 V, then the self-inductance of the coil is
    (A) 5 H (B) 10 H (C) 11 H (D) 22 H

11. The co-efficient of mutual induction between two circuits is equal to the e.m.f produced in one circuit when the current in the second circuit is _____.
    (A) kept steady at 1 ampere
    (B) cut off of 1 ampere level
    (C) changed at the rate of 1 A/s
    (D) changed from 1 A/s to 2 A/s

12. A coil of 50 turns is pulled in 0.02 s between the poles of a magnet, where its area includes $31 \times 10^{-6}$ Wb to $1 \times 10^{-6}$ Wb. The average e.m.f. is
    (A) $7.5 \times 10^{-2}$ V (B) $7.5 \times 10^{-3}$ V
    (C) zero (D) $7.5 \times 10^{-4}$ V

13. In a coil of area 10 $cm^2$ and 10 turns, the magnetic field is directed perpendicular to the plane and is changing at the rate of $10^8$ gauss/s. The resistance of the coil is 20 Ω. The current in the coil is
    (A) 5 ampere (B) 0.5 ampere
    (C) 0.05 ampere (D) $5 \times 10^8$ampere

14. When the north pole of a magnet is rapidly brought towards a coil
    (A) the face of the coil facing the north pole becomes a south pole.
    (B) the face of the coil facing the north pole becomes a north pole.
    (C) no induced e.m.f is produced.
    (D) the coil is deflected.

15. A conducting circular loop is placed in a uniform magnetic field 0.04 T with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at 2 mm/s. The induced e.m.f. in the loop when the radius is 2 cm will be
    (A) 3.2 πμV (B) 4.8 πμv
    (C) 0.8 πμV (D) 1.6 πμV

### Answers to Topic Test

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | (A) | 2. | (D) | 3. | (A) | 4. | (D) |
| 5. | (A) | 6. | (A) | 7. | (A) | 8. | (B) |
| 9. | (A) | 10. | (C) | 11. | (C) | 12. | (A) |
| 13. | (A) | 14. | (B) | 15. | (A) | | |

*Scan the adjacent QR code to download* ***Solution to Topic Test*** *in PDF format.*

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# Passage-based MCQs

**Read the given passages and answer the questions based on it.**

## 01 Electric Charges and Fields

### Passage - I (for Q. 1 to Q. 5)

The electric interaction between two charged bodies can be expressed in terms of the forces they exert on each other. Coulomb made the first quantitative investigation of the force between electric charges. He used point charges at rest to study the interaction. In due course, he formulated a law.

This law states that the force of attraction or repulsion between two point charges at rest is directly proportional to product of the charges and inversely proportional to square of the distance between them. This force acts along the line joining the two charges. If $q_1$ and $q_2$ are the charges separated by distance r then force of attraction or repulsion between them is given by, $F = K\frac{|q_1q_2|}{r^2}$ where, K is proportionality constant which equals to $\frac{1}{4\pi\varepsilon_0}$.

1. A charge of q C is divided into two charges $q_1$ and $q_2$ and kept at distance r from each other so that they will exert maximum force upon each other then,

   (A) $q_1 = q_2 = \frac{q}{2}$ (B) $q_1 = 0, q_2 = q$

   (C) $q_1 = q, q_2 = 0$ (D) $q_1 = \frac{q}{4}, q_2 = \frac{3q}{4}$

2. Two point charges separated by distance r in vacuum are attracting each other by force of 80 N. If the entire system is kept in medium of dielectric constant 80 without changing other parameters then, new force will be

   (A) 1 N repulsion (B) 1 N attraction

   (C) 80 N repulsion (D) 80 N attraction

3. The charges and coordinates of two charged particles held fix in xy plane are, $q_1 = +5.0\ \mu C$, $x_1 = 4$ cm, $y_1 = 0$ cm, $q_2 = -2.0\ \mu C$, $x_1 = 0$ cm, $y_1 = 3$ cm then magnitude of electrostatic force acting on $q_2$ will be

   (A) 36 N repulsion (B) 36 N attraction

   (C) 10 N repulsion (D) 10 N attraction

4. Two tiny conducting balls of identical mass and identical charge q hang from non conducting threads of length L. The equilibrium separation between the balls assuming θ between them is very small will be

   (A) $\left(\frac{q^2L}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$ (B) $\left(\frac{q^2L}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{2}}$

   (C) $\left(\frac{q^2L}{2\pi\varepsilon_0 mg}\right)$ (D) $\left(\frac{qL}{2\pi\varepsilon_0 mg}\right)$

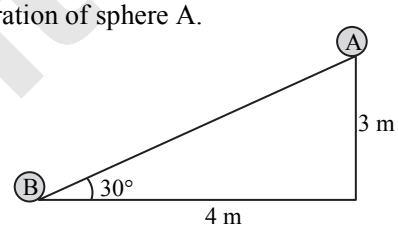
5. Two spheres each having mass 1 kg and charge 50 μC are placed on an inclined plane as shown in the figure. Neglecting the force of friction, find the acceleration of sphere A.

   (A) 5.8 m/s$^2$

   (B) 4 m/s$^2$

   (C) 4.9 m/s$^2$

   (D) 4.4 m/s$^2$




### Passage - II (for Q. 6 to Q. 10)

A system of closely spaced electric charges forms a continuous charge distribution.

On macroscopic level, quantisation of charges is ignored. For a charged body with reasonable size, its charge distribution is treated as continuous.

The continuous distribution can be categorized as linear, surface and volume charge distribution.

When charge is distributed along a line, charge distribution is called linear charge distribution. When charge is distributed over a surface, charge distribution is called surface charge distribution. When charge is distributed over the volume of an object, it is called volume charge distribution.

6. How many electrons need to be added to an isolated spherical conductor of radius 10 cm to produce an electric field of 1000 N/C, just outside the conductor?

   (A) $6.9 \times 10^9$ (B) $6.9 \times 10^{20}$

   (C) $3.5 \times 10^{10}$ (D) $3.5 \times 10^{20}$

7. A charge is distributed along an infinite curved line in space with linear charge distribution λ. Then amount of force on a point charge q kept at a certain distance from a line depends upon

   (A) $q\int\frac{\lambda}{r^2}$ (B) $q\int\frac{\lambda}{r^2}d\hat{l}\hat{r}$

   (C) $q\int\frac{\lambda}{r}\hat{r}\,dl$ (D) $q\int\frac{\lambda}{r}$

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# CUET (UG) - 2022 Question Paper

**6th August 2022 (Slot - 2)**

## Electric charges and fields

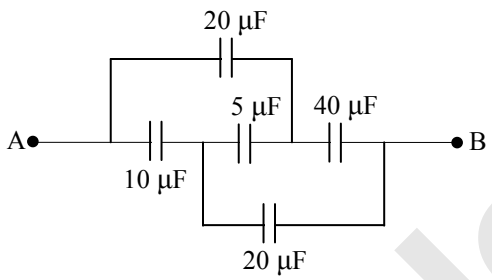
1. Electric field at the surface of a conducting shell of radius 'r' is measured as X. Electric field at a distance 3r from the centre of the shell is:

(A) $\frac{X}{3}$ (B) $\frac{X}{6}$

(C) $\frac{X}{9}$ (D) X

## Electrostatic potential and capacitance

2. The equivalent capacitance between the points A and B in the network given below is-




(A) 20 μF (B) $\frac{20}{3}$ μF

(C) $\frac{40}{3}$ μF (D) 10 μF

3. A charge + 10μC is placed at (0 mm, 0 mm) Another charge –5μC is moved from (3 mm, 0 mm) to (0 mm, 3 mm). Work done by the external agency is

(A) 0 J (B) –150 J

(C) + 150 J (D) – 300 J

## Current electricity

4. In a meter bridge, null point is found at a distance of 20 cm from the end A, then the resistance of 10 Ω is replaced by another resistance of 20 Ω, the null

(A) 20 cm

(B) 30 cm

(C) 15 cm

(D) 40 cm

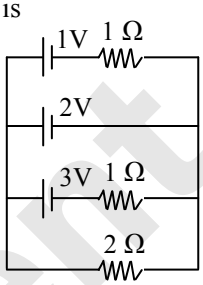
5. Changing current through 1V cell and through 2 Ω resistor respectively is

(A) 2A, 1A

(B) 1A, 2A

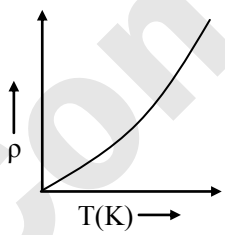
(C) 2A, 2A

(D) 1A, 1A

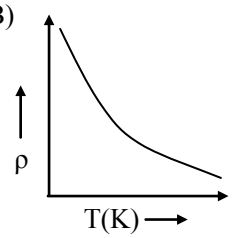



6. Correct temperature dependence of Resistivity of copper (ρ) is shown by

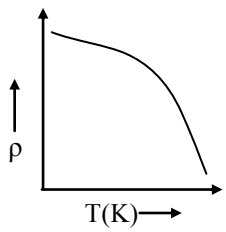
(A)



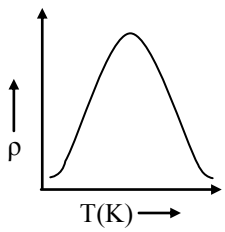

(B)




(C)




(D)




7. The mobility of charge carriers increases with

(A) increase in average collision time interval

(B) increase in the electric field

(C) increase in the mass of the charge carriers

(D) decrease in the charge of the mobile carriers

## Moving charges and magnetism

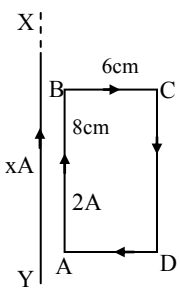
8. Consider an infinitely long conductor XY carrying current (x) A. A rectangular loop carrying current 2 A is placed parallel to it in the same plane. The two conductors are found to exert a force of $1.8 \times 10^{-5}$ N/m. Find the value of x.

(A) 0.6 A

(B) $3 \times 10^{2}$ A

(C) 3A

(D) $3 \times 10^{-2}$ A

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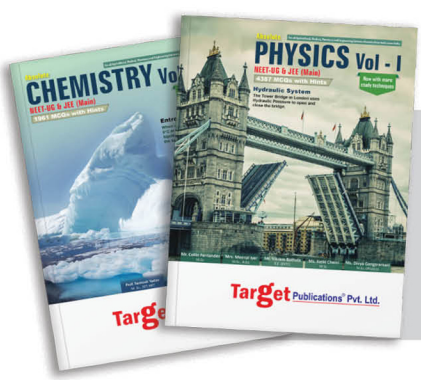


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