Railway Recruitment Board

RRB JE Electrical Engineering

Chapterwise Solved Papers

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still your suggestions and queries are welcomed.
In the event of any dispute, the judicial area will be Prayagraj.

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SYLLABUS

Government of India, Ministry of Railways, Railway Recruitment Boards

CENTRALISED EMPLOYMENT NOTICE (CEN) No.03/2018

Recruitment of Junior Engineer (JE), Junior Engineer (Information Technology) [JE(IT)], Depot Material Superintendent (DMS)

2nd Stage CBT : Short listing of Candidates for the 2nd Stage CBT exam shall be based on the normalized marks obtained by them in the 1st Stage CBT Exam. Total number of candidates to be shortlisted for 2nd Stage shall be 15 times the community wise total vacancy of Posts notified against the RRB as per their merit in 1st Stage CBT. However, Railways reserve the right to increase/decrease this limit in total or for any specific category(s) as required to ensure availability of adequate candidates for all the notified posts.

Duration : 120 minutes *(160 Minutes for eligible PwBD candidates accompanied with Scribe)*

No of Questions : 150

Syllabus : The Questions will be of objective type with multiple choices and are likely to include questions pertaining to General Awareness, Physics and Chemistry, Basics of Computers and Applications, Basics of Environment and Pollution Control and Technical abilities for the post. The syllabus for General Awareness, Physics and Chemistry, Basics of Computers and Applications, Basics of Environment and Pollution Control is common for all notified posts under this CEN as detailed below:-

a) **General Awareness :** Knowledge of Current affairs, Indian geography, culture and history of India including freedom struggle, Indian Polity and constitution, Indian Economy, Environmental issues concerning India and the World, Sports, General scientific and technological developments etc.

b) **Physics and Chemistry:** Up to 10th standard CBSE syllabus.

c) **Basics of Computers and Applications:** Architecture of Computers; input and Output devices; Storage devices, Networking, Operating System like Windows, Unix, Linux; MS Office; Various data representation; Internet and Email; Websites & Web Browsers; Computer Virus.

d) **Basics of Environment and Pollution Control:** Basics of Environment; Adverse effect of environmental pollution and control strategies; Air, water and Noise pollution, their effect and control; Waste Management, Global warming; Acid rain; Ozone depletion.

e) **Technical Abilities:** The educational qualifications mentioned against each post shown in Annexure-A, have been grouped into different exam groups as below. Questions on the Technical abilities will be framed in the syllabus defined for various Exam Groups given at Annexure-VII-A, B, C, D, E, F & G.

The section wise Number of questions and marks are as below :

Subjects	No. of Questions	Marks for each Section
	Stage-II	Stage-II
General Awareness	15	15
Physics & Chemistry	15	15
Basics of Computers and Applications	10	10
Basics of Environment and Pollution Control	10	10
Technical Abilities	100	100
Total	150	150
Time in Minutes	120	

The section wise distribution given in the above table is only indicative and there may be some variations in the actual question papers.

Minimum percentage of marks for eligibility in various categories: UR -40%, OBC-30%, SC-30%, ST -25%. This percentage of marks for eligibility may be relaxed by 2% for PwBD candidates, in case of shortage of PwBD candidates against vacancies reserved for them.

Virtual calculator will be made available on the Computer Monitor during 2nd Stage CBT.

2nd Syllabus for Electrical & Allied Engineering Exam Group-JE

SI. No.	Subject
1.	Basic concepts: Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units.
2.	Circuit law: Kirchhoff's law, Simple circuit solution using network theorems.
3.	Magnetic Circuit: Concepts of flux, mmf, reluctance, Different kinds of magnetic materials, Magnetic calculations for conductors of different configuration e.g. straight, circular, solenoidal, etc. Electromagnetic induction, self and mutual induction.
4.	AC Fundamentals: Instantaneous, peak, R.M.S. and average values of alternating waves, Representation of sinusoidal wave form, simple series and parallel AC Circuits consisting of R.L. and C, Resonance, Tank Circuit. Poly Phase system star and delta connection, 3 phase power, DC and sinusoidal response of R-L and R-C circuit.
5.	Measurement and measuring instruments: Measurement of power (1 phase and 3 phase, both active and re-active) and energy, 2 wattmeter method of 3 phase power measurement. Measurement of frequency and phase angle. Ammeter and voltmeter (both moving coil and moving iron type), extension of range wattmeter, Multimeters, Megger, Energy meter AC Bridges, Use of CRO, Signal Generator, CT, PT and their uses. Earth Fault detection.
6.	Electrical Machines: (a) D.C. Machine-Construction, Basic Principles of D.C. motors and generators, their characteristics, speed control and starting of D.C. Motors, Method of braking motor, Losses and efficiency of D.C. Machines. (b) 1 phase and 3 phase transformers– Construction, Principles of operation, equivalent circuit, voltage regulation, O.C. and S.C. Tests, Losses and efficiency. Effect of voltage, Frequency and wave form of losses. Parallel operation of 1 phase/3 phase transformers. Auto transformers. (c) 3 phase induction motors, rotating magnetic field, principle of operation, equivalent circuit, torque-speed characteristics, starting and speed control of 3 phase induction motors. Methods of braking, effect of voltage and frequency variation on torque speed characteristics, Fractional Kilowatt Motors and Single Phase Induction Motors : Characteristics and applications.
7.	Synchronous Machines: Generation of 3- phase e.m.f., armature reaction, voltage regulation, parallel operation of two alternators, synchronizing, control of active and reactive power, Starting and applications of synchronous motors.
8.	Generation, Transmission and Distribution: Different types of power stations, Load factor, diversity factor, demand factor, cost of generation, inter-connection of power stations. Power factor improvement, various types of tariffs, types of faults, short circuit current for symmetrical faults. Switchgears and Protection: Rating of circuit breakers, Principles of arc extinction by oil and air, H.R.C. Fuses, Protection against earth leakage/over current, etc Buchholz relay, Merz-Price system of protection of generators & transformers, protection of feeders and bus bars. Lightning arresters, various transmission and distribution system, comparison of conductor materials, efficiency of different system. Cable– Different type of cables, cable rating and derating factor.
9.	Estimation and costing: Estimation of lighting scheme, electric installation of machines and relevant IE rules. Earthing practices and IE Rules.
10	Utilization of Electrical Energy: Illumination, Electric heating, Electric welding, Electroplating, Electric drives and motors.
11.	Basic Electronics: Working of various electronic devices e.g. P N Junction diodes, Transistors (NPN and PNP type), BJT and JFET. Simple circuits using these devices.

UPMRC JE Electrical Syllabus

- **Basic Electrical Engg. And Elect. Measurements:** Concepts of currents, Voltage Resistance, Power and energy, their units, Ohm's law. Circuit Law. Kirchhoff's law Solution of simple network problems. Network theorems and their applications, Electro-magnetism concept of flux, Emf, Reluctance, Magnetic circuits, Electro-magnetic induction, Self and mutual inductance. A.C. fundamentals Instantaneous, peak, R.m.s. And average values of alternating waves. Equation of sinusoidal wave form, Simple series and parallel a.c. Circuits consisting of R.L. and C. Resonance, Measurement and measuring instruments moving coil and moving iron ammeters and voltmeters, Extension of range. Watt meters. Multimeters, Megger, Basic Electronics.
- **Electrical machines:** Basic principles D.C. motors of generators, their characteristics, Speed control and starting of D.C. motors. Losses and efficiency of D.C. machines.
- **1-phase and 3-phase Transformers:** Principles of Operation, Equivalent Circuit, Voltage Regulation O.C. and S.C Tests, Efficiency, Auto Transformers. Synchronous Machines. Generation of Three phase Emf, Armature Reaction. Voltage Regulation, Parallel operation of two alternators. synchronizing , Starting And Applications of synchronous Motors, 3-phase Induction Motor. Rotating Magnetic Field, principle of Operation Equivalent circuit. Torque speed characteristics, starting and speed control of 3-phase induction Motors, Fractional kW Motors, 1-phase induction motors A.C. series motor reluctance motor.
- **General, Transmission and Distribution:** Different types of power stations, Load factor, diversity factor, demand factor, simple problems theorem. cost of generation inter connection of power stations, power factor improvement. Various types of tariffs, Types of faults current for symmetrical faults, Switchgears-rating of circuit breakers. Principles of a arc extinction by oil and air, H.R.C. fuses, protection earthier leakage, Over current Buchholz relay Merge-Prize system of protection of generators & transformers, protection of feeders and bus bars. Lighting arresters, Various transmission and distribution systems, comparison of conductor materials, Efficiency for different systems.
- **Utilization of Electrical Energy:** Illumination, Electric heating, Electric welding, Electroplating, Electric drives and motors.
- **BASIC ELECTRICAL ENGINEERING**
  Basic concepts and principles of D.C and A.C fundamental, AC circuits, batteries, electromagnetic induction etc. including constant voltage and current sources.
- **ANALOG ELECTRONICS**
  Fundamental concepts of basic electronics and basic understanding of conductors, semiconductors and insulators, extrinsic and intrinsic semi-conductors, p-n junction, need of rectifiers in electronics, understanding of filters in rectifiers, tunnel diodes, LEDs, varactors diodes, working of transistors in various configurations; Concept of FETs and MOSFET etc.
- **CONTROL SYSTEMS**
  Basic elements of control system, open loop control system, closed loop control system, control system terminology, manually controlled closed loop systems, automatic controlled closed loop systems, basic elements of a servo mechanism, Examples of automatic control systems, use of equivalent systems for system analysis, linear systems, non-linear system, control system examples from chemical systems mechanical systems electrical systems, introduction to Laplace transform.
  Transfer function analysis of ac and dc servomotors synchronous, stepper motor, amplydyne. ac position control system, magnetic amplifier.
  Control system representation: Transfer function, block diagram, reduction of block diagram, problems on block diagram, Mason's formula signal flow graph
  Non-Linear Control System: Introduction, behavior of non-linear control system. Different types of nonlinearities, saturation, backlash, hysteresis, dead zone relay, function, characteristics of non-linear control system, limit cycles jump resonance, jump phenomenon. Difference between linear and non-linear control system.
- **ELECTRONIC COMPONENTS AND MATERIALS**
  - **Materials:** Classification of Materials, Conducting, semi-conducting and insulating materials through a brief reference to their atomic structure.
  - **Conducting Materials:** Resistors and factors affecting resistivity such as temperature, alloying and mechanical stressing. Classification of conducting materials into low resistivity and high resistivity materials.
  - **Insulating Materials:** Important relevant characteristics (electrical, mechanical and thermal) and applications of the following material: Mica, Glass, Copper, Sliver, PVC, Silicon, Rubber, Bakelite, Cotton, Ceramic, Polyester, Polythene and Varnish.
  - **Magnetic Materials:** Different Magnetic materials; (Dia, Para, Ferro) and their properties. Ferro-magnetism, Domains, permeability, Hysteresis loop. Soft and hard magnetic materials, their examples and typical applications.
- **MEASURING INSTRUMENTS**
  Introduction to Testing and Measurements, Measurement of Resistance, Inductance and Capacitance, Ammeter, Voltmeter and Multimeter, Power and Energy Measurements, Frequency and phase difference Measurement.
- **PRINCIPLES OF INSTRUMENTATION**
  Basic building blocks of any instrumentation systems, Performance characteristics of Oscillator Instruments, Instrument selection; Factors affecting instrument selection, accuracy, precision, linearity, resolution, sensitivity, hysteresis, reliability, serviceability, loading effect, range advantage and limitation cost effectiveness and availability Static and dynamic response-Environmental effects-Calibration tools
- **FUNDAMENTALS OF DIGITAL ELECTRONICS**
  Concepts of Digital electronics, Number system, gates, codes arithmetic logic circuits, flip-flops, shift resistors and counters.

ALP/Technician Online Exam Syllabus

Second Stage (CBT)

Total Duration : 2 hours and 30 minutes (for Part A and Part B together)
The Second Stage CBT shall have two parts viz Part A and Part B as detailed below.

PART A

Duration: 90 Min. **No. of Questions: 100**

Minimum percentage of marks for eligibuility in various categories: UR-40%, OBC-30%, SC-30%, ST-25%. These percentages of marks for eligibility may be relaxed by 2% for PWD candidates in case of shortage of PWD candidates against vacancies reserved for them.

The marks scored in Part A alone shall be used for short listing of candidates for further stages of recruitment process subject to the condition that the candidate is securing qualifying mark in Part B.

(A) Mathematics

Number system, BODMAS, Decimals, Fractions, LCM, HCF, Ratio and Proportion, Percentages, Mensuration, Time and Work; Time and Distance, Simple and Compound Interest, Profit and Loss, Algebra, Geometry and Trigonometry, Elementary Statistics, Square Root, Age Calculations, Calendar & Clock, Pipes & Cistern etc.

(B) General Intelligence and Reasoning

Analogies, Alphabetical and Number Series, Coding and Decoding, Mathematical operations, Relationships, Syllogism, Jumbling, Venn Diagram, Data Interpretation and Sufficiency, Conclusions and Decision Making, Similarities and Differences, Analytical reasoning, Classification, Directions, Statement– Arguments and Assumptions etc.

(C) Basic Science and Engineering

The board topics that are covered under this shall be Engineering Drawing (Projections, Views, Drawing Instruments, Lines, Geometric figures, Symbolic Representation), Units, Measurements, Mass Weight and Density, Work Power and Energy, Speed and Velocity, Heat and Temperature, Basic Electricity, Levers and Simple Machines, Occupational Safety and Health, Environment Education, IT Literacy etc.

General awareness on current affairs in Science & Technology, Sports, Culture, Personalities, Economics, Politics and other subjects of importance.

PART B

Duration: 60 Min. **No. of Questions: 75**
Qualifying Marks: 35%

Sl. No.	Engineering Discipline (Diploma/Degree)	Relevant trade for PART B Qualifying Test to be selected from
1.	Electrical Engineering and combination of various streams of Electrical Engineering	Electrician/Instrument Mechanic/Wiremen/Winder (Armature)/Refrigeration and Air Conditioning Mechanic

RRB JE Previous Exam Papers Analysis Chart

SR. NO	Exam.	Year	No. of Q.
RRB JE 2023			
1.	RRB JE (CRIS) Electrical	19.02.2023	96
DFCCIL 2023			
2.	DFCCIL Executive (Electrical) 2023	20.12.2023	96
3.	DFCCIL (S & T) 2023	17.12.2023	60
4.	DFCCIL Executive (Electrical) 2021	30.09.2021	96
5.	DFCCIL Executive (Electrical) 2018	13.11.2018	96
RRB JE 2019			
6.	RRB JE 2019	19.09.2019	100
7.	RRB JE 2019	01.09.2019	100
8.	RRB JE 2019	30.08.2019	100
RRB JE 2015			
9.	RRB JE 2015	26.08.2015 Shift-I	21
10.	RRB JE 2015	26.08.2015 Shift-II	24
11.	RRB JE 2015	26.08.2015 Shift-III	22
12.	RRB JE 2015	27.08.2015 Shift-I	25
13.	RRB JE 2015	27.08.2015 Shift-II	26
14.	RRB JE 2015	27.08.2015 Shift-III	21
15.	RRB JE 2015	28.08.2015 Shift-I	18
16.	RRB JE 2015	28.08.2015 Shift-II	20
17.	RRB JE 2015	28.08.2015 Shift-III	22
18.	RRB JE 2015	29.08.2015 Shift-I	24
19.	RRB JE 2015	29.08.2015 Shift-I	19
20.	RRB JE 2015	29.08.2015 Shift-I	23
21.	RRB JE 2015	30.08.2015 Shift-III	22
22.	RRB JE 2015	01.09.2015 Shift-I	20
23.	RRB JE 2015	01.09.2015 Shift-II	21
24.	RRB JE 2015	01.09.2015 Shift-III	19
25.	RRB JE 2015	02.09.2015 Shift-I	18

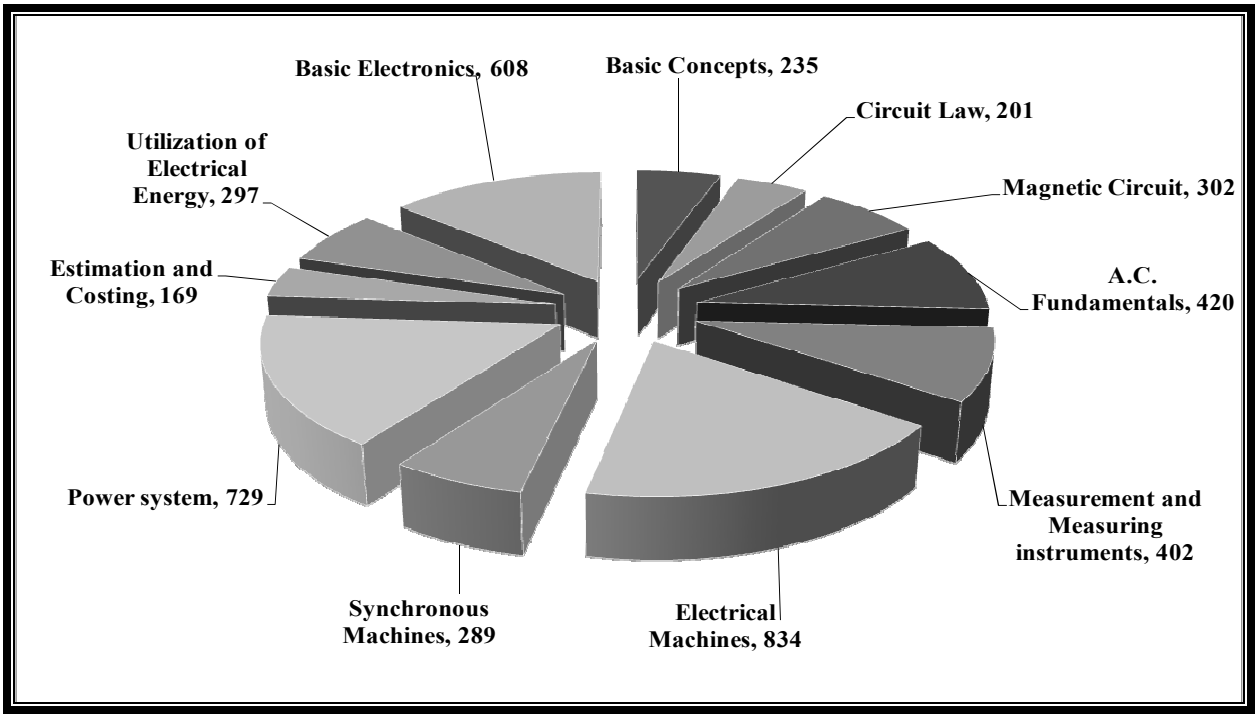
26.	RRB JE 2015	02.09.2015 Shift-II	17
27.	RRB JE 2015	02.09.2015 Shift-III	18
28.	RRB JE 2015	03.09.2015 Shift-I	15
29.	RRB JE 2015	03.09.2015 Shift-II	19
30.	RRB JE 2015	03.09.2015 Shift-III	20
31.	RRB JE 2015	04.09.2015 Shift-II	18
32.	RRB JE 2015	16.09.2015 Shift-I	21
33.	RRB Ranchi JE 2015	04.01.2015 Yellow Paper	20
34.	RRB Ranchi JE 2015	04.01.2015 Red Paper	25
RRB JE/Sr. SE Exam 2014			
35.	RRB SSE 2015	01.09.2015, Shift-I	21
36.	RRB SSE 2015	01.09.2015, Shift-II	22
37.	RRB SSE 2015	01.09.2015, Shift-III	21
38.	RRB SSE 2015	02.09.2015, Shift-I	20
39.	RRB SSE 2015	02.09.2015, Shift-II	21
40.	RRB SSE 2015	02.09.2015, Shift-III	22
41.	RRB SSE 2015	03.09.2015, Shift-I	22
42.	RRB SSE 2015	03.09.2015, Shift-II	21
43.	RRB SSE 2015	03.09.2015, Shift-III	20
44.	RRB JE (Bilaspur/Kolkata/Mumbai/Guwahati) 2014	14.12.2014 SET : 01 Red Paper	20
45.	RRB JE (CHENNAI) 2014	14.12.2014 SET : 02 Red Paper	26
46.	RRB JE (Bilaspur/Guwahati/Patna) 2014	14.12.2014 SET : 03 Green Paper	25
47.	RRB JE (Muzaffarpur) 2014	14.12.2014 SET : 04 Green Paper	28
48.	RRB JE (Bilaspur/Guwahati) 2014	14.12.2014 SET : 05 Yellow Paper	31
49.	RRB JE (Patna/Muzaffarpur/Chennai/Ahmedabad/ Bangalore) 2014	14.12.2014 SET : 06 Yellow Paper	21
50.	RRB Sr. SE (Bilaspur/Secunderabad) 2014	21.12.2014 SET : 07 Red Paper	18

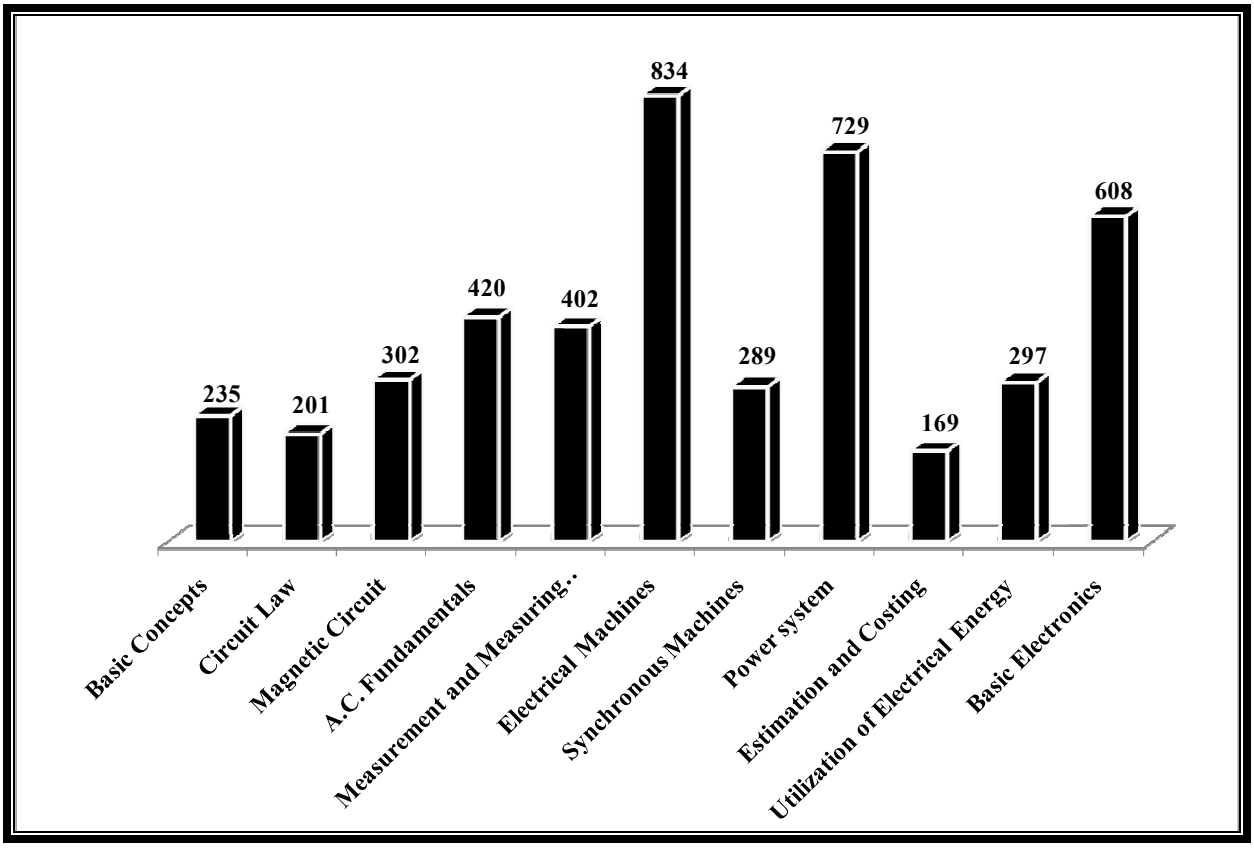
51.	RRB Sr. SE (Bilaspur/Secunderabad) 2014	21.12.2014 SET : 08 Green Paper	25
52.	RRB Sr. SE (Bilaspur/Secunderabad) 2014	21.12.2014 SET : 09 Yellow Paper	21
53.	RRB Sr. SE (BHOPAL) 2014	21.12.2014	15
DMRC JE Exam			
54.	DMRC JE 2020	26.02.2020	75
55.	DMRC JE 2020	20.02.2020	75
56.	DMRC JE 2018	20.04.2018	75
57.	DMRC JE 2018	09.04.2018 (4:00PM-6:45PM)	75
58.	DMRC JE 2018	09.04.2018 (12:15PM - 2:30PM)	75
59.	DMRC JE 2018	10.04.2018 (12:15PM - 2:30PM)	75
60.	DMRC JE 2017	18.02.2017	75
61.	DMRC JE 2017	22.09.2017	75
62.	DMRC JE 2016	06.03.2016	75
63.	DMRC JE 2015	15.03.2015	75
64.	DMRC JE 2014	07.09.2014	75
65.	DMRC JE 2013	21.07.2013	75
UPMRC/LMRC/JMRC/NMRC/BMRCL JE Exam			
66.	UPMRC JE 2023	03.01.2023 (9:00 -11AM)	90
67.	UPMRC SCTO 2021	17.04.2021 (12:00-2:00PM)	90
68.	JMRC JE 2019	05.02.2021	50
69.	NMRC JE 2019	15.09.2019	45
70.	LMRC JE 2016	17.03.2016	75
71.	LMRC JE 2015	26.06.2015	75
72.	JMRC JE 2012	23.12.2012	50
73.	NMRC JE 2017	05.03.2017	75
74.	JMRC JE 2017	10.06.2017	50
75.	BMRCL JE 2019	24 Feb. 2019	75

OTHER RAILWAY JE & SSE Exams.			
76.	RRB Bhubneshwar JE-II 2010	19.12.2010	19
77.	RRB Allahabad JE 2010	19.12.2010	25
78.	RRB Allabahad SSE 2010	19.12.2010	23
79	RRB Mumbai JE 2008	05.10.2008	28
80.	RRB Mumbai SSE 2008	05.10.2008	31
81.	RRB Mumbai JE 2010	19.12.2010	22
82.	RRB Mumbai SSE 2010	19.12.2010	26
83.	RRB Bhubneshwar JE-II 2010	19.12.2010	20
84.	Konkan Railway STA 2017	2017	24
85.	Konkan Railway TA 2017	2017	18
86.	Konkan Railway SSE 2015	2015	31
87.	RRB Kolkata Diesel JE 2009	25.10.2009	23
88.	RRB Chandigarh SSE 2009	25.10.2009	26
89.	RRB Mumbai C&G JE 2009	25.10.2009	24
90.	RRB Gorakhpur RDSO SSE 2009	25.10.2009	25
91.	RRB Jammu JE 2009	25.10.2009	23
92.	RRB Malda SSE 2009	25.10.2009	27
93.	RRB Allahabad JE 2009	25.10.2009	21
94.	RRB Mumbai C&G SSE 2009	25.10.2009	26
95.	RRB Patna JE	25.10.2009	23
96.	RRB Bhopal TM SSE 2009	25.10.2009	24
97.	RRB Allahabad SSE 2012	09.09.2012	25
98.	RRB Banglore SSE 2012	09.09.2012	29
99.	RRB Kolkala SSE 2012	09.09.2012	18
100.	RRB Gorakhpur Design SSE 2012	09.09.2012	23
101.	RRB Bhopal SSE 2012	09.09.2012	25
102.	RRB Chandigarh SSE 2012	09.09.2012	28
103.	RRB Jammu SSE 2012	09.09.2012	23
104.	RRB Allahabad JE 2012	09.09.2012	21
105.	RRB Bhubneshwar JE II 2008	29.11.2008	25
106.	Konkan Railway STA 2017	2017	23

107.	Konkan Railway TA 2017	2017	24
108.	Konkan Railway SSE 2015	2015	20
109.	RRB Kolkata Diesel JE 2009	25.10.2009	22
110.	RRB Bhopal Section Engineer,	24.11.2002	24
111.	RRB Bhopal & Mumbai Apprentice Section Engg.	23.03.2003	28
112.	RRB Secunderabad Section Engineer (Elect.)	29.06.2008	22
113	RRB Bangalore Section Engineer (Elect.)	01.02.2009	23
114.	RRB Chandigarh Section Engineer,	15.03.2009	25
115.	RRB Chennai Section Engineer,	12.02.2012	27
116.	RRB Chandigarh Section Engineer (Elect.)	26.02.2012	24
117.	RRB Chandigarh Section Engineer,	26.02.2012	29
118.	RRB Jammu Section Engg., 2013	2013	20
119.	RRB Bhubaneswar Section Engineer (Electrical)	19.08.2001	18
120.	RRB Kolkata Engineer (P.Way)	20.02.2000	15
121.	RRB Kolkata Apprentice Engineer	14.10.2001	20
122.	RRB Bangalore Material Engineer	21.11.2004	23
123.	RRB Bangalore Material Engineer	21.11.2004	21
124.	RRB Kolkata Mech. Engineer	06.02.2005	15
125.	RRB Allahabad Junior Engineer-II	08.01.2006	15
126.	RRB Kolkata Jr. Engineer-II Electrical DRG & Design,	11.06.2006	15
127.	RRB Kolkata Technical- Engineer	20.08.2006	28
128.	RRB Chennai Technical (Engineer)	15.04.2007	25
129.	RRB Bangalore Technical (Engineer)	22.04.2007	27
130.	RRB Secunderabad Technical (Engineer)	20.05.2007	22
131.	RRB Patna Technical Engineer,	27.07.2008	28
132.	RRB Thiruvananthapuram Section Eng. (Electrical)	04.01.2009	19
133.	RRB Bangalore Section Engineer (Electrical)	01.02.2009	23
134.	RRB Chandigarh Section Engineer (Electrical)	15.03.2009	26
135.	RRB Chandigarh Section Engineer (Electrical)	26.02.2012	27
136.	RRB Chandigarh Section Engineer (Electrical)	26.02.2012	29
137.	RRB Bhopal Section Engineer	24.11.2002	20
		Total	**5687**

Trend Analysis of Electrical Questions Through Pie Chart and Bar Graph





01. Basic Concepts

Basic concepts : Concepts of resistance, inductance, capacitance, and various factors affecting them. Concepts of current, voltage, power, energy and their units.

1. For a given conductor, if the cross-sectional - area increases, then:-
(a) resistance of the conductor increases
(b) resistance of the conductor decreases
(c) current rating of the conductor decreases
(d) resistance of the conductor does not change
RRB JE (CRIS) Electrical 19.02.2023, 12:30-2:30 PM
DMRC JE, 26.02.2020
RRB JE 01.09.2019 Shift-I
RRB Mumbai SSE 05.10.2008

Ans. (b) : Resistance is inversely proportional to the cross sectional area of the conductor.
Hence, if the cross sectional area increases then resistance of conductor decreases.
■ The resistance of the conductor is directly proportional to the length.

$$R = \rho\frac{\ell}{A}\Omega$$

Where,
R = Resistance
ℓ = Length
ρ = resistivity of conductor
A = Cross section area

2. If a 100 Watts bulb is ON for 10 hours, then that will be the amount of electricity consumed?
(a) 1500 Watts (b) 1 kWh
(c) 300 Watts (d) 100 Watts per hour
RRB JE (CRIS) Electrical 19.02.2023, 12:30-2:30 PM
RRB JE 01.09.2019 Shift-I

Ans. (b) : Given, P = 100W
P = 0.1 kW
Time = 10 h
Energy in kWh = power (kW) × time (h)
= 0.1 × 10 = 1 kWh

3. 1 watt = _____ ergs per second,
(a) 10^7 (b) 10
(c) 10^{-7} (d) 100
DFCCIL Executive Electrical-20.12.2023

Ans. (a) :
1 watt = 10^7 ergs per second
1 watt = 1 Joule per second
The erg is a unit of energy and one erg equal to 10^{-7} Joules.

4. What is the relation between resistance ($R_1$and R_2) of two bulbs rated for the same voltage and having powers of 400 W and 100 W respectively?
(a) $R_1=4R_2$ (b) $R_2=4R_1$
(c) $R_2=2R_2$ (d) $R_2=2R_1$
RRB JE (CRIS) Electrical 19.02.2023, 12:30-2:30 PM
DMRC JE, 26.02.2020

Ans. (b) : Given that,
$P_1 = 400W$, $P_2 = 100W$

$$P = \frac{V^2}{R}$$

If voltage rating of bulb is same-

$$P \propto \frac{1}{R}$$

So, $\frac{P_1}{P_2} = \frac{R_2}{R_1}$

$$\frac{400}{100} = \frac{R_2}{R_1}$$

$$\boxed{R_2 = 4R_1}$$

5. Ampere is the S.I. unit of .....
(a) Charge (b) Voltage
(c) Resistance (d) Current
DFCCIL Executive Electrical 30.09.2021
(Konkan Railway STA 2017)

Ans. (d) : Ampere is the SI unit of electric current. The rate of charge flow is called current.

Current $I = \frac{q}{t}$ = Coulomb/second

Parameter	Unit
Resistance	ohms
Voltage	Volt
Capacitor	Farad
Magnetic flux	Weber
Inductance	Henry

6. Two incandescent lamps of wattage 40W, 60 W are connected in series with voltage of 230 V. Which out of the two lamps will glow brighter?
(a) 40 W (b) 60 W
(c) both brightly (d) both dim
DFCCIL Executive Electrical-20.12.2023
(RRB Mumbai SSE 05.10.2008)

Ans. (a) : 40 watt lamp glow brighter

$\because$ $P = \frac{V^2}{R}$

$R \propto \frac{1}{P}$ for given voltage

$R_1 = \frac{1}{40}$, $R_2 = \frac{1}{60}$

$\boxed{R_1 > R_2}$

$P_1 = I^2R_1$, $P_2 = I^2R_2$ (In series I is same)
$I^2R_1 > I^2R_2$
As both resistance of lamp connected in series then current flowing in them will be square and power losses

of a lamp is equivalent to I^2R. So that lamp glow brighter which resistance is larger or power rating will low. i.e. in which power losses will more then it glow brighter.

7. Which of the following is the base unit ?

(a) Frequency (b) Velocity
(c) Force (d) Time

DFCCIL Executive Electrical-20.12.2023

Ans. (d) : SI base unit is an international system of measurement that are used universally in technical and scientific research to avoid the confusion with the units.

Name of the Quantity	SI Unit
Length	Meter
Mass	Kilogram
Time	Second
Current	Ampere
Temperature	Kelvin
Amount of substance	Mole
Luminious intensity	Candela

8. An important consequence of Gauss's law is.....

(a) Ohm's law (b) Ampere's law
(c) Kirchoff's law (d) Coulomb's law

DFCCIL Executive Electrical-20.12.2023

Ans. (d) : An important consequence of Gauss's law is Coulomb's law.
Gauss's law states that the net flux of an electric field in a closed surface is directly proportional to the enclosed electric charges.

$$\frac{Q}{\varepsilon_0}$$

9. If a resistance has the following colour code, find the value of resistance.
Gray, Red, Green, Silver

(a) $82k\Omega \pm 10\%$ (b) $8.2k\Omega \pm 10\%$
(c) $82M\Omega \pm 10\%$ (d) $8.2M\Omega \pm 10\%$

DMRC JE 20.02.2020

Ans. (d) : The value of resistance for given colour code is $8.2\ M\Omega \pm 10\%$.

Colour	Digit	Multiplier	Tolerance
Black	0	10^0	–
Brown	1	10^1	±1%
Red	2	10^2	±2%
Orange	3	10^3	–
Yellow	4	10^4	–
Green	5	10^5	± 0.5%
Blue	6	10^6	± 0.25%
Violet	7	10^7	± 0.1%
Gray	8	10^8	± 0.05%
White	9	10^9	–
Gold		10^{-1}	± 5%
Silver		10^{-2}	± 10%
Colourless		–	± 20%

Hence,
Gray, Red, Green, Silver.
$82\times10^5\pm 10\%$
or $8.2\ M\Omega \pm 10\%$

10. An energy source flows a steady current of 2A to 10s in an electric bulb. If it emits 2.3 kJ of energy in the form of light and thermal energy. Find the voltage drop in the bulb?

(a) 130 V (b) 260 V
(c) 115 V (d) 230 V

DMRC JE 20.02.2020

Ans. (c) : Given that, $i = 2A$
$t = 10s$
$H = 2.3kJ = 2.3\times10^3J$

$H = i^2Rt$

$$R = \frac{H}{i^2t} = \frac{2.3\times10^3}{4\times10} = 57.5\Omega$$

Voltage drop = iR
$(V) = 2\times57.5=115V$

11. Which of the following type of resistors has highest value of temperature coefficient?

(a) Wire wound (b) Carbon film
(c) Metal film (d) Carbon composition

CRIS Electrical JE-19.02.2023
DMRC JE 20.02.2020

Ans. (c) : Metal film resistors has highest value of temperature coefficient from given option.

12. If the current flowing through the conductor is 5A, then electrons per second will flow in the conductor at any passage.

(a) 6.25×10^{18} (b) 31.35×10^{17}
(c) 31.35×10^{19} (d) 31.35×10^{18}

DMRC JE 20.02.2020

Ans. (d) : Given that,
Current (i) = 5A, Time (t) = 1 sec
Charge on electron (e) = 1.6×10^{-19}Coulomb
We know that-
$Q = it$
$ne = it \quad (\because Q = ne)$

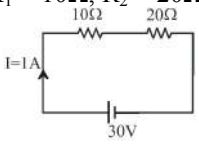
$$n = \frac{it}{e} = \frac{5\times1}{1.6\times10^{-19}} = 31.25\times10^{18} \simeq 31.35\times10^{18}$$

13. Two resistors R_1= 10Ω and R_2= 20Ω are connected in series order to a 30V direct current (DC) source. Find the ratio (P_1/P_2) of the power expended by the resistors.

(a) $P_1/P_2 = 1/3$ (b) $P_1/P_2 = 1/4$
(c) $P_1/P_2 = 1/2$ (d) $P_1/P_2 = 2/1$

DMRC JE 20.02.2020

Ans. (c) : Given, $R_1 = 10\Omega$, $R_2 = 20\Omega$



$$I = \frac{V}{R} = \frac{30}{10+20} = \frac{30}{30} = 1A$$

$P_1 = I^2R_1 = 10W$

$P_2 = I^2R_2 = 20W$

$P_1/P_2 = 10/20 = 1/2$

14. How much energy will be a 100W electric bulb spend in two hours?

(a) 72 kJ (b) 7200 J
(c) 720 J (d) 720 kJ

DMRC JE 20.02.2020

Ans. (d) : Given,
$P = 100W \qquad t = 2hr = 2 \times 3600$
$t = 7200$ Sec
Energy = Power × time
$E = P \times t$
$E = 100 \times 7200$
$E = 720$ kJ

15. 1 Joule of electrical energy equals:
(a) 1 watt. sec (b) 1 watt
(c) 1 watt/sec (d) 1 volt ampere

DMRC JE 2018, Shift-I

Ans. (a) : Energy consumed in electrical power system is-
$E = P \times t$
Joule = watt.sec
1 Joule = 1 watt.sec

16. A varistor is made of:
(a) Copper (b) Carbon film
(c) Carborundum crystals (d) Aluminium

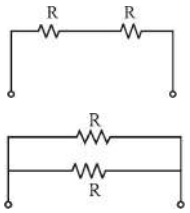
DMRC JE 2018, Shift-I

Ans. (c) : A varistor is an electronic component with-an electrical resistance that varies with the applied voltage. It is made of carborundum crystals. It is also known as voltage dependent resistor. Silicon carbide is also known as corborundum crystal.

17. Two equal resistors are first connected in series and then in parallel across a dc supply. What is the ratio (series circuit to parallel circuit) of total heat dissipated by the resistors for the two cases at a given time?
(Assume that the current from the dc source is same in both cases.)
(a) 2:3 (b) 1:2
(c) 4:1 (d) 3:2

DMRC JE, 26.02.2020

Ans. (c) : Assume current from dc source is same in both (series & parallel) case is same-
For series connection-
$R_{eq} = R + R = 2R$
Heat dissipated $H_1 = 2i^2Rt$



For parallel
$R_{eq} = \frac{R}{2}$

Heat dissipated $H_2 = i^2 \frac{R}{2} t$

$$\frac{H_1}{H_2} = \frac{2i^2Rt}{i^2\frac{Rt}{2}} = \frac{4}{1}$$

$$\boxed{H_1 : H_2 = 4 : 1}$$

18. Capacitance of a capacitor is given by:
(a) $C = \frac{\varepsilon_0 \varepsilon_r d}{A}$ (b) $C = \frac{\mu A}{d}$
(c) $C = \frac{A}{d}$ (d) $C = \frac{\varepsilon_0 \varepsilon_r A}{d}$

DMRC JE 2018, Shift III

Ans. (d) : The capacitance of a parallel plates capacitor can be given by-

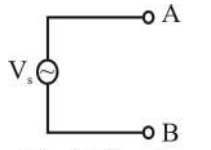
$$C = \frac{\varepsilon_0 \varepsilon_r A}{d}$$

Where, ε_0 = Absolute permittivity
ε_r = Relative permittivity
A = Area of each plate
d = Distance between plates
■ Capacitance is measure in Farad.

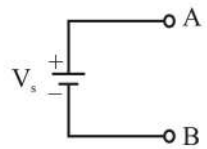
19. An ideal voltage source is one which has:
(a) infinite internal resistance
(b) zero internal resistance
(c) very high internal resistance
(d) very low internal resistance

DMRC JE 2018, Shift III

Ans. (b) : An ideal voltage sources has zero internal resistance whereas an ideal voltmeter has infinite internal resistance.



Ideal AC voltage source



Ideal DC voltage source

■ A practical voltage source should be minimum internal resistance.
■ A practical current source should be very high internal resistance.
■ An ideal current source must be infinite internal resistance.

20. Estimate the resistance of the filament of a 50 W, 100 V bulb.
(a) 200Ω (b) 100Ω
(c) 50Ω (d) 150Ω

DMRC JE 2018, Shift III

Ans. (a) : Given, P = 50W, V = 100V, R = ?
As we know that $R = \frac{V^2}{P}$

$$R = \frac{(100)^2}{50} = \frac{10000}{50}$$
$$R = 200\Omega$$

21. If 1 A current flows in a circuit, the number of electrons flowing through this circuit is
(a) 0.625×10^{19} (b) 1.6×10^{19}
(c) 1.6×10^{-19} (d) 0.625×10^{-19}

DMRC JE 18.02.2017

Ans. (a) : Given, Current (i) = 1A
Charge (q) = 1C
Charge on electron = 1.6×10^{-19} C.
$q = ne$

$$n = \frac{q}{e} = \frac{it}{e} \qquad (q = it)$$

$$n = \frac{1}{1.6 \times 10^{-19}} = 0.625 \times 10^{19}$$

It means 6.25×10^{18} electrons flow through the cross section of the wire to make possible the flow of 1C per second.

22. An electrical short circuit is characterized by:
(a) High resistance (b) Medium resistance
(c) Zero resistance (d) Infinite resistance

DMRC JE 18.02.2017

Ans : (c) In an electric circuit, the value of resistance in short circuit is zero.
■ In an electric circuit the value of resistance in open circuit is infinite.

23. An electric bulb of rating 40W, 220V is used for 10 hrs daily for 10 days. Energy consumed is :
(a) 3 kWh (b) 4 kWh
(c) 6 kWh (d) 5 kWh

DMRC JE 18.02.2017

Ans : (b) Given, P = 40 Watt
V = 220 V
Time = 10 hours

$$\text{Energy consumed} = \frac{\text{Watt} \times \text{hours} \times \text{day}}{1000}$$

$$\text{Energy consumed} = \frac{40 \times 10 \times 10}{1000} = 4\text{kWh}$$

24. Electric charge of a body is a condition due to:
(a) Deficiency or excess of neutrons
(b) Deficiency of electrons
(c) Deficiency or excess of electrons
(d) Excess of electrons

DMRC JE 18.02.2017

Ans : (c) The reason for the charge on the body is deficiency or excess of electrons. An atom gets an electric charge when it gains or loses electrons. In an independent state an atom is neutral because the number of electrons and protons are equal but the charge of opposite nature. Due to equal and opposite charge whole atom is neutral.

25. 1 Volt = _____.
(a) 1 Joule/ 1 Coulomb (b) 1 Watt/ 1 Ohm
(c) 1 Joule / 1 Watt (d) 1 Watt/1 Coulomb

DMRC JE 18.02.2017

Ans : (a) One volt is defined as the electric potential or (electric pressure) between two points of a conducting wire when an electric current of one ampere dissipates one watt of power between those points.

$$\text{Voltage} = \frac{\text{Work done}}{\text{Charge}} = \frac{W}{Q}\,\text{Joule/coulomb}$$

26. Calculate the power taken by each of the two resistors of value 100Ω, connected in parallel across 100V supply:
(a) 1500W (b) 1.5 W
(c) 100 W (d) 2000 W

DMRC JE 18.02.2017

Ans : (c) Power taken by each resistor,

$$P = \frac{V^2}{R}$$

$$P = \frac{100 \times 100}{100}$$

$$P = 100\text{watt}$$

27. The value of free electron density of copper
(a) $16 \times 10^{28}/m^3$ (b) $1.69 \times 10^{19}/m^3$
(c) $8 \times 10^{28}/m^3$ (d) $8.5 \times 10^{28}/m^3$

DMRC JE 18.02.2017

Ans : (d) Free electron density of copper = $8.5 \times 10^{28}\ /\ m^3$
Resistivity of copper (ρ) = $1.72 \times 10^{-8}\Omega$-m

28. The angular velocity of a sinusoidal voltage is:
(a) $\omega = 1 / T$ (b) $\omega = 2\pi / f$
(c) $\omega = T/f$ (d) $\omega = 2\pi f$

DMRC JE 18.02.2017

Ans : (d) The angular velocity of sinusoidal voltage $\omega = 2\pi f$ radian/second

29. The capacitor in circuit opposes the sudden change of:
(a) Voltage (b) temperature
(c) Energy (d) current

DMRC JE 03.08.2014

Ans. (a) : The capacitor in circuit opposes the sudden change of voltage. Because a capacitor is storing element that stored the energy in electric field. Current in a capacitor is given by -

$$\boxed{i_c(t) = C\frac{dV_c}{dt}}$$

Since current in a capacitor does not goes to zero abruptly therefore capacitor oppose the rate of change of voltage.

30. What is the unit of electric current?
(a) Farad (b) Newton
(c) Ampere (d) Coulomb

RRB JE 01.09.2019, Shift-I

Ans. (c) : The SI unit of electric current is the ampere, which is defined as flow of one coulomb of charge per second or 6.25×10^{18} electrons per second.

31. What is the SI unit of resistivity?
(a) ohm-meter (b) Siemens / meter
(c) coulomb / meter (d) ampere / meter

DMRCE JE 26.02.2020

Ans. (a) : The SI unit of resistivity is ohm meter.

$$\text{Resistance}(R) = \rho\frac{\ell}{A}$$

$$\rho = \frac{RA}{\ell} = \Omega - m$$

Where, ρ = resistivity of material
ℓ = length of conductor
A = Area of conductor

32. Which of the following expressions gives the Joule's law of heating?
(a) $H \alpha IRt$ (b) $H \alpha IR^2t$
(c) $H \alpha I^2Rt$ (d) $H \alpha I^2R/t$

RRB JE 19.09.2019 Shift-II

Ans. (c) : Joule's law of heating states that when a current (I) passes through a conductor of resistance (R) for time (t) then the heat developed in the conductor is equal to the product of the square of the current, the resistance and time.
or $H = I^2Rt$
Then $H \propto I^2Rt$

33. If three 5 μF capacitors are connected in parallel, then the net capacitance is-
(a) 25 μF (b) 10 μF
(c) 125 μF (d) 15 μF

RRB JE 19.09.2019 Shift-II

Ans. (d) : According to question three 5μF capacitors are connected in parallel

Then net capacitance = 5 μF +5 μF +5 μF

= 15 μF

34. Components which obey Ohm's law are known as-

(a) Resistors
(b) Capacitors
(c) Non-ohmic components
(d) Ohmic components

RRB JE 19.09.2019 Shift-II

Ans. (d) : Ohmic components follow ohm's law. Ohm's law is defined as the current through a conductor between two points is directly proportional to the voltage across the two points.

$$I = \frac{V}{R}$$

35. If a power of 100 W is being supplied across a potential difference of 200 V, find the current flowing through the circuit.

(a) 0.5 A (b) 1 A
(c) 20 A (d) 2 A

RRB JE 01.09.2019 Shift-I

Ans. (a) : Given, P = 100 W

Potential difference (P.D) = 200V

$\because P = VI$

$\therefore I = \frac{P}{V}$

$I = \frac{100}{200} = \frac{1}{2} = 0.5\,A$

36. Which of the following have the same unit, ms^{-1}?

(a) Velocity and acceleration
(b) Speed and velocity
(c) Acceleration and momentum
(d) Speed and momentum

RRB JE 01.09.2019 Shift-I

Ans. (b) : Speed and velocity have the same unit, ms^{-1}

Difference between speed and velocity-

Speed	Velocity
1. The speed is the distance travelled by a body in a unit time.	1. The velocity is the displacement of a body in a unit time.
2. It is a scalar quantity. The speed does not tell us the direction of the motion of a body.	2. It is a vector quantity. The velocity tells us the speed and direction of the motion of a body.
3. The speed is always positive	3. The velocity can be positive and negative depending on the direction of the motion
4. During the circular motion, the average speed does not become zero after completing one round.	4. During the circular motion, average velocity becomes zero after completing one round.
5. Unit = $\frac{m}{s} = ms^{-1}$	5. Unit = $\frac{m}{s} = ms^{-1}$

37. The total opposition offered to the flow of current in AC circuit is called-

(a) Inductance (b) Resistance
(c) Impedance (d) Capacitance

DFCCIL Executive Electrical 30.09.2021
RRB JE 01.09.2019 Shift-I

Ans. (c) : The combined effects of resistance, inductive reactance and capacitive reactance is called impedance. Which produced the total opposition to current flow in an AC circuit.

The total opposition offered to the flow of current in AC circuit is called impedance. It is combination of resistance (R) and reactance (X).

then

$Z = R + jX$

38. Two bulbs of 500 W and 200 W rated at 250 V will have resistance ratio as-

(a) 2 : 3 (b) 2 : 5
(c) 3 : 2 (d) 5 : 2

RRB JE 01.09.2019 Shift-I

Ans. (b) : Given, $P_1 = 500W$, $P_2 = 200W$

$\because P = \frac{V^2}{R}$

$\therefore R = \frac{V^2}{P}$ $\quad \boxed{R \propto \frac{1}{P}}$

$\frac{R_1}{R_2} = \frac{P_2}{P_1} = \frac{200}{500} = \frac{2}{5}$

$R_1 : R_2 = 2 : 5$

39. The centripetal force required to keep the moon in its orbit is provided by which force?

(a) Spring force
(b) Gravitational force of earth
(c) Mechanical force
(d) Friction force

RRB JE 01.09.2019 Shift-I

Ans. (b) : Gravitational attraction provides the centripetal force needed to keep planets in orbit around the sun and all types of satellite in orbit around the Earth. The earths gravity keeps the moon orbiting us.

40. Calculate the total DC resistance of a 100 metre roll of 2.5 mm^2 copper wire if the resistivity of copper at 20^o C is 1.72×10^{-8} Ω metre.

(a) 0.867 Ω (b) 0.713 Ω
(c) 0.214 Ω (d) 0.688 Ω

RRB JE 01.09.2019 Shift-I

Ans. (d) : Given

$A = 2.5\ mm^2 = 2.5\times(10^{-3})^2 = 2.5 \times 10^{-6}\,m^2$

$\rho = 1.72 \times 10^{-8}\ \Omega - m$

$\ell = 100$ meter

$R = \rho\frac{\ell}{A}$

$R = 1.72\times10^{-8} \times \frac{100}{2.5\times10^{-6}}$

$R = 0.688\,\Omega$

41. What is the SI unit of electric charge?

(a) Volt (V) (b) Joule (J)
(c) Coulomb (C) (d) Ampere (A)

RRB JE 01.09.2019 Shift-I

Ans. (c) : The SI unit of electric charge is coulomb.

Parameter	Unit
Resistance	ohms
Voltage	Volt
Capacitor	Farad
Magnetic flux	Weber
Inductance	Henry

42. If three 10 μF capacitors are connected in series, then the value of equivalent capacitance is-

(a) 3.33 μF (b) 1.33 μF
(c) 1.66 μF (d) 0.3 μF

RRB JE 30.08.2019 Shift-II

Ans. (a) : Given,
$C_1 = C_2 = C_3 = C = 10\mu F$

For series combination - $C_{eq} = \frac{C}{n}$

$$C_{eq} = \frac{10}{3} = 3.33\mu F$$

43. If one of the parallel resistors in any parallel circuit is removed from the circuit, then the total resistance-

(a) Doubled (b) Increases
(c) Remains the same (d) Decreases

RRB JE 30.08.2019 Shift-II

Ans. (b) : If one of the parallel resistors in any parallel circuit is removed from the circuit, then the total resistance increase.

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} ....$$

$R_1 = R_2 = R_3 = R$

$$\boxed{R_{eq} = \frac{R}{n}}$$

$n \rightarrow$ No. of Resistance

$R_{eq} \uparrow \quad n \downarrow$

Parallel resister is removed from the circuit the resistance will be increased.

44. Determine the value of current (in A) that flows through a resistor of 9 ohms, when the potential difference between the ends of the resistor is 36 V.

(a) 8 (b) 7
(c) 4 (d) 3

(RRB Allahabad JE 19.12.2010)

Ans : (c) Given,
$R = 9\ \Omega, V = 36$ Volt

Current (I) = $\frac{V}{R} = \frac{36}{9} = 4$ Amp

45. Which one of the following statement is TRUE about the Ohm's law?

(a) Ohm's law is applicable to the diodes.
(b) Ohm's law is not applicable to diodes.
(c) Ohm's law is appilicable to voltage regulators.
(d) Ohm's law is applicable to transistors.

(RRB Mumbai JE 05.10.2008)

Ans : (b) Ohm's laws does not apply to diodes. Ohm's law applies only to linear circuit. Diode, transistors, SCRs, etc. are all non-linear devices.

According to Ohm's law, $I \propto V$

$$I = \frac{V}{R}$$

$$R = \frac{V}{I}$$

That is the ratio of $\frac{V}{I}$ in an electrical network is a constant value.

46. How much time (in sec) will be taken by 40 C of charge to pass through a point in a circuit, if a current of 8 A flows through it ?

(a) 2 (b) 3
(c) 4 (d) 5

(RRB Bhubneshwar JE-II 19.12.2010)

Ans : (d) Given−
Charge (q) = 40 Coulomb
Electric current (I) = 8 Amp.
Time (t) = ?
$q = I\,t$

Time (t) = $\frac{40}{8} = 5$ second

47. Which of the following is the correct expression for the electrical power?

(a) VR (b) $\frac{V}{R}$
(c) V^2R (d) $\frac{V^2}{R}$

RRB Chandigarh SSE 09.09.2012

Ans : (d) $\frac{V^2}{R}$ is the correct expression for electric power.

$P = I^2R$

$$P = \left(\frac{V}{R}\right)^2 R \qquad \left(\because I = \frac{V}{R}\right)$$

$$\boxed{P = \frac{V^2}{R}}$$

D.C. power in an electric circuit is the product of voltage and current.
P = VI while AC real power in an electric is P = VI cos ϕ.

48. Which of the following are immobile?

(a) Electrons (b) Holes
(c) Ions (d) None of these

(RRB Bhubneshwar JE-II 19.12.2010)

Ans : (c) Ion is in motionless whereas electron and hole are in motion. The value of mobility of electron in semiconductor is more than that of hole.

49. The S.I. unit of electrical energy is ……

(a) Watt (b) Volts
(c) Ampere (d) Joule

(RRB Mumbai JE 05.10.2008)

Ans : (d) The SI unit of electrical energy is Joule.
■ The S.I. unit of power (P) is watt.

Power $\boxed{(P) = \frac{w}{t}\text{ watt}}$

Energy $\boxed{E = vit}$ joule

Energy = Power × Time
Energy = Watt-second
Joule = Watt-second

50. Which of the following symbol represents absolute permittivity of dielectric medium correctly?

(a) ε_r (b) ε_0

(c) $\varepsilon_r \times \varepsilon_0$ (d) $\varepsilon_r / \varepsilon_0$

(RRB Bhubneshwar JE-II 19.12.2010)

Ans. (c) : Absolute permittivity $(\varepsilon) = \varepsilon_0\varepsilon_r$

ε_0 = free space electric permittivity

$\varepsilon_0 = 8.854 \times 10^{-12}$ F/m

$\boxed{\varepsilon = \varepsilon_0 \times \varepsilon_r \text{ F/m}}$

■ $\in_r$ is relative permittivity. It has no units. Its value varies for different substances and its value is 1 for air.

51. Which of the following is the dimension of resistance?

(a) $\frac{ML^2}{Q^2T}$ (b) $\frac{Q^2T^2}{ML^2}$

(c) $\frac{ML^2}{QT^2}$ (d) $\frac{ML}{QT^2}$

(RRB Allahabad JE 19.12.2010)

Ans. (a) : Dimension of resistance is $\frac{ML^2}{Q^2T}$

$Q = IT$

$\boxed{I = \frac{V}{R}}$

$Q = \frac{VT}{R}$ $\qquad \boxed{V = \frac{W}{Q}}$

$R = \frac{VT}{Q} = \frac{WT}{Q^2} = \frac{ML^2T^{-2}T}{Q^2} = \frac{ML^2}{Q^2T}$

52. Which of the following statements is correct about capacitors?

(a) None of these

(b) The capacitor disconnects short circuit in direct current (DC) circuits and connectes in alternating current (AC) circuits

(c) The capacitor disconnects short circuit in both direct current (DC) and alternating current (AC) circuits

(d) the capacitor disconnects circuit in direct current (DC) circuits and short circuit in alternating current (AC) circuits

(RRB Mumbai SSE 05.10.2008)

Ans : (d) The capacitor blocks the DC supply. That is the capacitor in the circuit behaves like an open circuit and passed the capacitor AC supply. That is, the capacitor behaves like a short circuit in AC circuit.

53. 'Erg' is a unit of measurement for ……

(a) Energy (b) Power

(c) Voltage (d) Impedance

(RRB Mumbai SSE 05.10.2008)

Ans. (a) : 'Erg' is a unit of measurement of energy. Generally the unit of energy is joule or watt second. Energy is a scalar quantity. Energy is the capacity to do work.

$\boxed{1 \text{Joule} = 10^7 \text{erg}}$

54. If 12.25×10^{16} electrons pass through a conductor in 1 s, then how much current (in mA) will

(a) 17.6 (b) 18.6

(c) 19.6 (d) 20.6

(RRB Kolkata JE 25.10.2009)

Ans. (c) : Given,

$e = 1.6 \times 10^{-19}$ C

$n = 12.25 \times 10^{16}$

$t = 1$sec

$q = ne$

$q = 1.6 \times 10^{-19} \times 12.25 \times 10^{16}$ C

$q = 19.6 \times 10^{-3}$ C

$\begin{cases} q = ne \\ q = it \\ i = \frac{q}{t} \end{cases}$

$it = q$

$i = \frac{q}{t} = \frac{19.6 \times 10^{-3}}{1}$

$\boxed{i = 19.6 \text{ mA}}$

55. Find the odd one out regarding Ohm's Law.

(a) Vacuum tubes (b) Conductor

(c) DC circuit (d) High Voltage Circuit

(RRB Gorakhpur SSE 25.10.2009)

Ans : (a) Vacuum tube does not obey Ohm's law–

■ **Ohm's law**–The physical state of a conductor if remaining unchanged, the ratio of the potential difference (V) and the current (I) across the conductor is always constant which is called resistance.

$I \propto V$

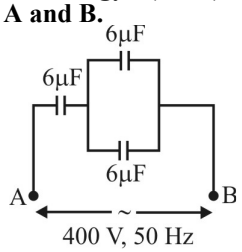
$I = V/R$

$\frac{V}{I} = R$ (Constant)

Where R = resistance

■ Ohm's law is applicable only for linear circuits.

56. For the circuit shown below, find the electrostatic energy (in J) stored between terminals A and B.



(a) 0.32 (b) 3.32

(c) 33.2 (d) 332

(RRB Allahabad JE 25.10.2009)

Ans. (a) : For given circuit equivalent capacitance

$C_{AB} = \frac{(6+6)\times6}{(6+6)+6} = \frac{12\times6}{18} = 4\mu F$

$C_{AB} = 4\mu F$

Electrostatic energy $(E)=\frac{1}{2}CV^2$ Joule

Given V = 400 V

$=\frac{1}{2}\times4\times10^{-6}\times400\times400=320000\times10^{-6}$ Joule

$\boxed{=0.32\text{ Joule}}$

57. Which of the following is true for 3.9 k resistor using color-coding technique?

(a) red, white, red, gold
(b) red, green, orange, silver
(c) orange, green, orange, silver
(d) orange, white, red, gold

(RRB Patna JE 25.10.2009)

Ans. (d) : Formula $ab\times10^{c}\pm$ tolerance

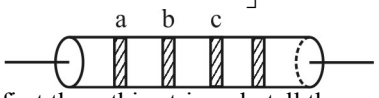
$3.9\times10^{3}\pm5\%$

$39\times10^{2}\pm5\%$

Orange White Red Gold

■ Color coding is used only for carbon register and the following formula is used to calculate the value of any colour coded resistance.

$\left[R=ab\times10^{c}\pm\text{tolerance}\right]$



In this the first three thin strip only tell the resistance and the fourth thin strips tells tolerance.

Determining the color code–

B ⇒ Black ⇒ 0	G ⇒ Green ⇒ 5
B ⇒ Brown ⇒ 1	B ⇒ Blue ⇒ 6
R ⇒ Red ⇒ 2	V ⇒ Violet ⇒ 7
O ⇒ Orange ⇒ 3	G ⇒ Gray ⇒ 8
Y ⇒ Yellow ⇒ 4	W ⇒ White ⇒ 9

Silver ⇒ ±10% tolerance

Gold ⇒ ±5% tolerance

No Band ⇒ ±20% tolerance

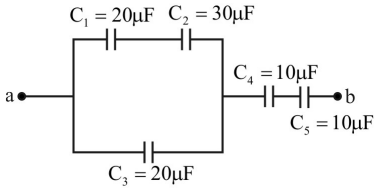
58. What material, swamping resistance is made up?

(a) Alloy of nickel and cobalt
(b) Alloy of manganin and aluminium
(c) Alloy of manganin and copper
(d) None of these

(RRB Patna JE 25.10.2009)

Ans. (c) : The swamping resistance is made alloy of manganin and copper. It is used to reduce the temperature error.

59. What is the equivalent capacitance (in μF) for the circuit given below?



(a) 4.56 (b) 4.32
(c) 54.62 (d) 54.28

(RRB Allahabad JE 19.12.2010)

Ans. (b) : Equivalent capacitance of C_1 and C_2

$C=\frac{C_1C_2}{C_1+C_2}$ (C_1 and C_2 in series)

$=\frac{20\times30}{50}=\frac{600}{50}=12\mu F$

Now the equivalent capacitance of 12μF and C_3

$C=C_3+12\mu F$ ($\because$ 12μF and C_3 is in parallel order)

$=20+12$

$C=32\mu F$

Now, 32μF, $10\mu F(C_4)$ and $10\mu F(C_5)$ are in series

Equivalent capacitance $\frac{1}{C_{ab}}=\frac{1}{32}+\frac{1}{10}+\frac{1}{10}$ (in series)

$=\frac{1}{32}+\frac{1}{5}$

$\frac{1}{C_{ab}}=\frac{5+32}{160}=\frac{37}{160}$

$C_{ab}=\frac{160}{37}=4.32\,\mu F$

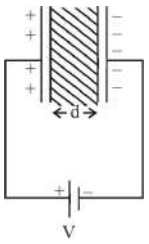
60. Which of the following is the CORRECT expression for the capacitance of a parallel plate capacitor?

(a) $\frac{\varepsilon A}{d}$ (b) $\frac{\varepsilon A^2}{d}$

(c) εA^2d^2 (d) $\frac{A^2d}{\varepsilon}$

(RRB Mumbai JE 05.10.2008)

Ans : (a) The capacitance of a parallel plate capacitor is $\frac{\varepsilon A}{d}$.



Formula: $D=\frac{Q}{A}$ ...(1)

$E=\frac{D}{\varepsilon}=\frac{Q}{A\varepsilon}$ ...(2)

$E=\frac{V}{d}$ ...(3)

$V=Ed$

$V=\frac{Q}{A\varepsilon}d$

(put the value of E from equation 2)

$\frac{A\varepsilon}{d}=\frac{Q}{V}=C$

$\boxed{C=\frac{\varepsilon A}{d}}$ Farad

D = Surface charge density
E = electric field
ε = Permittivity
A = Area of plate
Q = Change on plates
d = distance between two plates

61. What will be the voltage (in V) of a battery connected to a parallel plate capacitor with air as dielectric, having plate area of 6 sq. cm and separation between the plates is 2mm, which stores a charge of 8.0 pC on the plates?

(a) 3 (b) 9 (c) 6 (d) 5

(RRB Allahabad JE 19.12.2010)

Ans : (a) Given,

$q = 8pC$, Area $(A) = 6cm^2$

$q = 8\times10^{-12}$ C, $A = 6\times10^{-4}$ m^2

$d = 2\times10^{-3}$m, $\varepsilon_0 = 8.854\times10^{-12}$F/m

$\epsilon_r = 1$

$$\text{Capacitance}(C) = \frac{\varepsilon_0 A}{d}\text{F}$$

$$= \frac{8.854\times10^{-12}\times6\times10^{-4}}{2\times10^{-3}}$$

$$= \frac{8.854\times6\times10^{-16}}{2\times10^{-3}} = \frac{8.854\times6\times10^{-13}}{2}$$

$$= 8.854\times3\times10^{-13}\ \text{F}$$

Battery voltage $V = \frac{q}{C}$

$$V = \frac{8\times10^{-12}}{8.854\times3\times10^{-13}}$$

$$V = \frac{8\times10^{-12}\times10^{13}}{8.854\times3}$$

$$V = \frac{80}{8.854\times3} = \frac{80}{26.562}$$

$V = 3.01\,\text{Volt} \simeq 3\,\text{Volt}$

62. An ammeter reads 0.5A when connected in series with an unknown resistance and a voltmeter connected across the ends of the same resistance shows 50V. Then value of that resistance is:

(a) 100Ω (b) 50Ω
(c) 25Ω (d) 1Ω

(RRB Allahabad JE 19.12.2010)

Ans. (a) : Given−

Voltmeter Reading = 50V

Ammeter Reading = 0.5A

$$\text{Resistance (R)} = \frac{\text{Voltmeter Reading}}{\text{Ammeter Reading}} = \frac{50}{0.5} = \frac{500}{5}$$

$R = 100\Omega$

63. Determine the capacitance (in F) of a parallel plate capacitor placed in air if the area of the parallel plate capacitor is $2m^2$ and the distance between the plates is 0.02m.

(a) 7.56×10^{-11} (b) 9.65×10^{-10}
(c) 8.85×10^{-10} (d) 6.65×10^{-10}

(RRB Kolkata JE 25.10.2009)

Ans. (c) : Given,

Area of parallel plate $(A) = 2m^2$

Distance between of plates $(d) = 0.02m$

$C = ?$, $\varepsilon_0 = 8.854\times10^{-12}$ F/m

$\varepsilon_r = 1$(Air)

$\varepsilon = \varepsilon_0\varepsilon_r$

formula; $C = \varepsilon\frac{A}{d}$

$$C = \frac{8.854\times10^{-12}\times2}{0.02}$$

$C = 8.854\times10^{-10}$ F

64. The ability of a charged particle to do work is known as :

(a) magnitude
(b) magnetism
(c) potential difference
(d) electric potential energy

(RRB Mumbai SSE 05.10.2008)

Ans. (d) : The capacity of a charged particle to do work is called electric potential energy.

65. The SI unit of conductivity is :

(a) Ohm/meter (b) Ohm-meter
(c) Siemens/meter (d) Siemens-meter

(RRB Patna JE 25.10.2009)

Ans. (c) : Conductivity of a conducting material is the inverse of resistivity.

$$\text{Conductivity}(\sigma) = \frac{1}{\text{Resistivity}(\rho)}$$

$$= \frac{1}{\frac{Ra}{\ell}} = \frac{1}{\Omega\ \text{m}} = \text{℧/ m (mho/meter)}$$

or Siemens/meter

66. Ohm's law is valid for:

(a) all conductors
(b) all nonlinear devices
(c) all temperature
(d) all metals

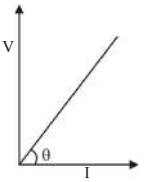
[LMRC (SCTO). 16.04.2018, 1st Shift]

Ans : (a) Ohm's law is valid for all conductors. According to this law "If the physical state of a conductor remains unchanged. Then the ratio of the potential difference (V) across the ends of the conductor and the current is always constant.

$\frac{V}{I} = R$

R = Constant

$R = \text{Tan}\theta = \frac{V}{I}$



67.. The number of basic SI unit is-

(a) 7 (b) 5
(c) 4 (d) 6

(RRB Allahabad JE 19.12.2010)

Ans : (a) The number of basic SI units is seven.

Basic Quantity	SI Units
Length	Meter (m)
Mass	Kilogram (kg)
Time	Second (s)
Current	Ampere (A)
Temperature	Kelvin (K)
Quantity of matter	mol (mol)
Luminous intensity	Candela (Cd)

68. Which of the following quantity will remain the same, when a layer of Teflon is inserted between the plates of a charged parallel plate capacitor ?
(a) Capacitance (b) Charge
(c) Energy of the capacitor (d) Potential
(RRB Allahabad JE 19.12.2010)

Ans. (b) : There will be no change in charge when a layer of Telfon is inserted between the plates of the capacitor. Because charge is conserved.

$$\boxed{C = \frac{\varepsilon A}{d}} \text{ Farad}$$

$$\boxed{q = CV}$$

q = charge
V = potential
C= Capacitor
d = Distance between of plates.

69. Which of the following is NOT a type of capacitor?
(a) Ceramic (b) Electrolytic
(c) Film (d) Wire wound
(RRB Mumbai JE 05.10.2008)

Ans. (d) : Ceramic, film and electrolyte are types of capacitor. While wire wound is a type of resistor. Wound register is an electrically passive component to make it, nichrome or magnine wire is wrapped over a ceramic or glass core material. It is made with high power rating.

70. Electric field intensity at any point is equal to:
(a) Potential gradient at that point
(b) Potential at that point
(c) Potential difference at that point
(d) Work done at that point
(RRB Patna JE 25.10.2009)

Ans : (a) Electric field intensity at any point is equal to potential gradient at that point.
Potential gradient→ Rate of change of potential with respect to displacement in the direction of electric field, i.e. dv/dx
■ It unit is volt/meter or volt/cm.
■ Suppose in an electric field of strength E, having two points dx meter apart. The potential difference (dv) between them is–
$dV = E(-dx) = -E.dx$

$$\therefore \quad E = -\frac{dV}{dx}$$

The negative sign indicates that the E is directed outward, while potential increases inward. Hence, it means that E at a point is equal to the negative potential gradient at that point.

$$\vec{E} = -\vec{\nabla}V = -\overrightarrow{\text{grad}}\, V$$

$$\vec{E} = -\left(\frac{\partial}{\partial x}\hat{i} + \frac{\partial}{\partial y}\hat{j} + \frac{\partial}{\partial z}\hat{k}\right)V$$

71. Farad is the S.I unit of.....
(a) Inductance (b) Resistance
(c) Capacitance (d) Reluctance
(RRB Gorakhpur SSE 25.10.2009)

Ans. (c) : Farad is the S.I. unit of capacitance.

$$C = \frac{q}{V} = \text{coulomb/volt or farad}$$

$$= \frac{q^2}{W} \qquad \left(\because V = \frac{W}{q}\right)$$

■ The dimensional formula of capacitance is $[M^{-1}L^{-2}T^2Q^2]$ or $M^{-1}L^{-2}T^4A^2$.

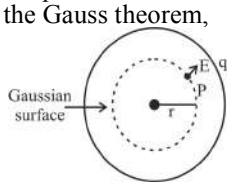
72. Three wires having conductances 2,3 and 6 mho respectively are connected in parallel in a circuit. The equivalent resistance in the circuit will be :
(a) 11 ohms (b) 1 ohm
(c) 1/11 ohms (d) 33 ohms
(RRB Allahabad JE 25.10.2009)

Ans : (c) $G_1 = 2\,\text{mho}$
$G_2 = 3\,\text{mho}$
$G_3 = 6\,\text{mho}$
$G_{eq} = G_1 + G_2 + G_3$ (In parallel)
$= 2 + 3 + 6 = 11\,\text{mho}$

$$R = \frac{1}{G} = \frac{1}{11}\Omega$$

73. Inside a hollow conducting sphere, electric field...
(a) is zero
(b) is a non-zero constant
(c) changes with the magnitude of the charge given to the conductor
(d) changes with distance from the centre of the sphere
(RRB Patna JE 25.10.2009)

Ans : (a) Inside a hollow conducting sphere, electric field is zero.
Let us consider a charged hollow sphere with charge q. The charge q is on the surface of the sphere. We have to calculate the electric field at an interior point P distance r from the centre. If we imagine a Gaussian spherical surface through the point P concentric with the given shell, we can use the Gauss theorem,



$$E \times 4\pi r^2 = \frac{q'}{\varepsilon_o} \text{ or } \oint \vec{E}.\overrightarrow{ds} = 0 \quad [q_{in} = 0]$$

where q' is the charge enclosed by this Gaussian surface = 0

$$\therefore \quad E_{in} = 0$$

74. Which of the following is the dimension of capacitance ?
(a) $\frac{ML^2}{A^2T^3}$ (b) $\frac{A^2T^4}{ML^2}$
(c) $\frac{M^2L^2}{A^2T^4}$ (d) $\frac{A^2T^3}{ML^2}$
(RRB Allahabad JE 19.12.2010)

Ans : (b) The dimension of capacitance $\frac{A^2T^4}{ML^2}$

Capacitance $(C) = \frac{Q}{V}$

We knows, Q = It and $V = \frac{W}{Q}$

$$C = \frac{Q}{\frac{W}{Q}}, \quad C = \frac{Q^2}{W} = \frac{(it)^2}{W} = \frac{\left[A^2T^2\right]}{\left[ML^2T^{-2}\right]}$$

$$\boxed{C = \left[M^{-1}L^{-2}A^2T^4\right]}$$

or $\boxed{C = \frac{\left[A^2T^4\right]}{\left[ML^2\right]}}$

75. Coulomb's law for the force between electric charges closely resembles with____:

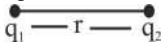
(a) Newton's law of motion
(b) Law of conservation of energy
(c) Gauss's theory
(d) 'Newton's law of gravitation'

(Konkan Railway STA 2017)

Ans : (d) Coulomb's law for the force between electric charges closely resembles with Newton's law of gravitation.

■ According to Coulomb's law, the electrostatic force between two point charge q_1 and q_2 separated by a distance r, is given by the equation:

$$F = \frac{q_1 q_2}{4\pi \varepsilon_0 r^2}$$

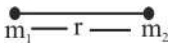


$$= \frac{kq_1q_2}{r^2}$$

Here,
ε_0 is the permittivity of free space
$k = 9 \times 10^9$ N.m^2/C^2 is the coulomb's constant.

■ According to Newton's law of gravitation, the gravitational force between two point masses is given by the equation

$$F = \frac{Gm_1m_2}{r^2}$$

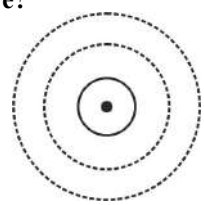


Here, G = 6.67 × 10^{-11} m^3/kg.s^2 is the gravitational constant.

→ m_1 and m_2 are the masses of the two objects respectively.

→ r is the distance between them.

76. What is the direction of magnetic lines of force in the current carrying conductor shown in below figure?

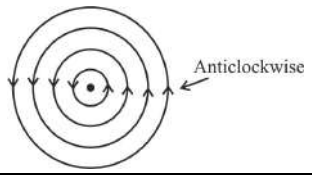


(a) clockwise (b) anticlockwise
(c) upwards (d) downwards

(RRB Bhopal TM SSE 25.10.2009)

Ans : (b) The direction of magnetic lines of force in the current carrying conductor in given figure is anticlockwise.

In given figure the flux distribution in a conductor carrying current coming outward to the plane. The direction of the field is determined either with the help of the Flemming right hand rule or right hand screw rule.



77. Determine the voltage (in V) of a battery connected to a parallel plate capacitor (filled with air) when the area of the plate is 10 square centimeters, the separation between the plates is 5 mm and the charged stored on the plates is 20 pC.

(a) 12.3 (b) 10.3
(c) 11.3 (d) 14.3

(RRB Mumbai JE 05.10.2008)

Ans : (c) Given−

Area of plate (A) = 10 cm^2 = 10 × 10^{-4} m^2

Distance between plate (d) = 5 mm = 5 × 10^{-3} m

Stored charge (q) = 20 × 10^{-12} C

From capacitance $(C) = \frac{\varepsilon A}{d} = \frac{\varepsilon_0 \varepsilon_r A}{d}$

$$C = \frac{8.85\times10^{-12}\times10\times10^{-4}}{5\times10^{-3}} \left(\text{For Air } \varepsilon_r = 1\right)$$

$\because$ $$V = \frac{Q}{C} = \frac{20\times10^{-12}\times5\times10^{-3}}{8.85\times10^{-12}\times10\times10^{-4}}$$

$$V = \frac{20\times5\times10}{8.85\times10} = 11.29944\,\text{V}$$

or $\boxed{V \cong 11.3 \text{ Volt}}$

78. Which of the following is highest mobility.

(a) Neutron (b) Ion
(c) Electron (d) Proton

(Konkan Railway TA 2017)

Ans : (c) Mobility of electron is highest.

■ Charge on an electron is 1.6×10^{-19} coulombs and weight of electron is 9.1×10^{-31} kg.

■ Electron is a negative charge particle.

79. A capacitance stores charge 0.3 coulomb on 2 volt, its capacitance is–

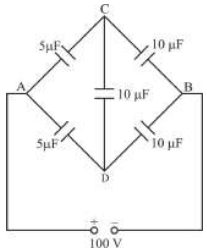
(a) 0.15F (b) 0.3F
(c) 2F (d) 0.6F

(RRB Mumbai SSE 05.10.2008)

Ans : (a) Given, V= 2volt
q = 0.3 coulomb
C =?

$$C = \frac{q}{V} = \frac{0.3}{2} = 0.15 \text{ Farad}$$

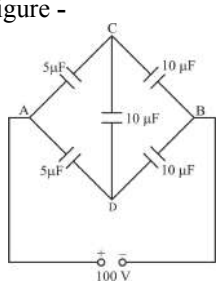
80. Calculate the equivalent capacitance (in μF) between point A and B.



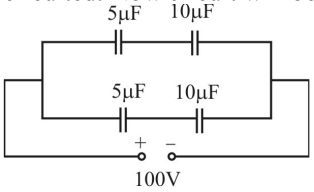
(a) 6.7 (b) 8.7
(c) 9.7 (d) 10.7

(RRB Chandigarh SSE 25.10.2009)

Ans : (a) Given figure -



This bridge is a balance bridge, so that we removes the capacitance between C and D because there will no charge flowing between them, that is C and D open circuited. Now circuit will be,



$$C_{eq} = \frac{10\times5}{10+5} + \frac{10\times5}{10+5}$$

$$\boxed{C_{eq} = \frac{100}{15} = 6.7\mu F}$$

81. Inside a conducting sphere, ... remains constant

(a) Potential (b) Charge
(c) Electric flux density (d) Current

DMRC JE Electrical-2017

Ans : (a) Inside a conducting sphere, potential remains constant always because there is no charge inside the charged sphere, all charge distributed on the surface of sphere. So, inside the sphere the electric field intensity is also zero and potential remains constant.

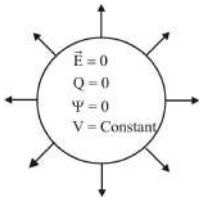
■ Mathematically,

Inside the charge sphere

$q = 0, \psi = 0$

then $E = 0$ also

$$E = \frac{dV}{dx} \Rightarrow 0 = \frac{-dV}{dx}$$



$dV = 0 \Rightarrow V_1 - V_2 = 0 \Rightarrow V_1 = V_2$

That is voltage difference is zero but voltage is constant with surface. voltage always constant in the charged sphere.

82. Permittivity of vaccum is :

(a) 9×10^{9}F/m (b) 8.854×10^{-12}F/m
(c) $4\pi \times 10^{-7}$F/m (d) 8.987×10^{-9}F/m

DMRC JE Electrical-2017

Ans : (b) Permittivity of vaccum is 8.854×10^{-12} F/m.

Permittivity–In electrostatics a certain property of the medium is called its permittivity. Every medium have two permittivities

(i) Absolute permittivity (ε)

(ii) Relative permittivity (ε_r)

For vacuum $\varepsilon_0 = 8.854\times10^{-12}$ F/m

$\boxed{\varepsilon_r = 1}$

Relation between ε and ε_r.

$\boxed{\varepsilon = \varepsilon_0\varepsilon_r}$

83. Which one of the following has the ability to store energy in the form of electric charge?

(a) Superconductor (b) Resistor
(c) Capacitor (d) Inductor

(RRB Allahabad JE 19.12.2010)

Ans : (c) Capacitor has the ability to store energy in the form of electric charge.

■ Capacitor opposes the change in voltage across it.

■ Capacitor is stores energy in electric field in the form of charge.

■ Energy stored in a capacitor is $(U) = \frac{1}{2}CV^2$

$\because q = CV \Rightarrow V = \frac{q}{C}$ or $C = \frac{q}{V}$

then $U = \frac{1}{2}C\left(\frac{q}{C}\right)^2 = \frac{1}{2}\frac{q^2}{C}$

or $U = \frac{1}{2}\times\frac{q}{V}\times(V)^2 = \frac{1}{2}qV$

$$\boxed{U = \frac{1}{2}CV^2 = \frac{1}{2}\frac{q^2}{C} = \frac{1}{2}qV}$$

■ Energy per unit volume of dielectric medium for a capacitor.

$$= \frac{1}{2}\varepsilon E^2 = \frac{1}{2}DE = \frac{D^2}{2\varepsilon} \text{ joules/m}^3$$

where,

E = electric field strength across capacitor.

D = charge density

ε = dielectric strength

q = charge on capacitor

C = capacitance of capacitor

V = voltage across capacitor.

84. In any electric circuit the flow of electron constitutes :

(a) magnetic charge
(b) an electric current
(c) an electric charge
(d) an electro motive force

LMRC JE (Electrical)-2016

Ans : (b) Current is the rate of flow of electron or charge.

■ If n electron flow in t second with each electron has charge then,

$I = \frac{ne}{t} = \frac{Q}{t}$ coulomb/second.

■ The current per unit area is called current density. It is a vector quantity.

$$J = \frac{I}{A} A/m^2$$

$$\boxed{I = \vec{J}.\vec{A}}$$

■ Unit of emf is volt.

85. Which of the following is a scalar quantity?
(a) Electric field strength
(b) Electric displacement density
(c) Electric potential
(d) Force

(RRB Chandigarh SSE 25.10.2009)

Ans : (c) Electric potential is a scalar quantity.
Scalar quantity–That quantities in which have magnitude and not direction is called scalar quantity.
Example–potential, speed, distance, mass, density, time, volume, current, temperature etc.
Vector quantity–That quantities which have magnitude and direction both is called vector quantity. It is denoted by ($\rightarrow$) vector.
Example–Electric field strength, current density, displacement, velocity, force etc. all the above quantity works in a particular direction.

86. If a voltage changes instantly the current through a resistor connected across it–
(a) Does not change
(b) Changes after some time
(c) Changes instantly
(d) None of the other options

(RRB Allahabad JE 25.10.2009)

Ans : (c) If a voltage changes instantly the current through a resistor connected across it changes instantly because
According to Ohm's law–
The ratio of potential (V) between any two points on a conductor to the current (I) flowing between them, is constant, provided the temperature of the conductor does not change.

$$\frac{V}{I} = R = \text{constant}$$

■ Resistor does not oppose the change in current but opposes current.
■ Inductor opposes the sudden change in current.
■ Capacitor opposes the sudden change in voltage.

87. Determine the separation between the plates (in mm)of a parallel plate capacitor placed in air, when the area of the plates is 0.002 sq. meter, the voltage of the battery connected to this parallel plate capacitor is 4 V and the charge stored on the plates is 16 pC.
(a) 4.4 (b) 2.6
(c) 5.8 (d) 6.4

(RRB Mumbai SSE 05.10.2008)

Ans : (a) Area of plate = 0.002 m^2
Voltage (V) = 4 volt
Charge (q) = 16×10^{-12} Coulomb
$\varepsilon_0 = 8.85 \times 10^{-12}$ Farad/meter

$$\text{Capacitance (C)} = \frac{q}{V} = \frac{16 \times 10^{-12}}{4} = 4 \times 10^{-12} \text{ Farad}$$

Now, from (C) = $\frac{\varepsilon_0 \varepsilon_r A}{d}$
distance between plates (d)

$$= \frac{\varepsilon_0 \varepsilon_r A}{C} = \frac{8.85 \times 10^{-12} \times 1 \times 0.002}{4 \times 10^{-12}} = 0.004425\text{m}$$

or $\boxed{d = 4.4\,\text{mm}}$

88. Electric field is defined as:
(a) Potential per unit distance
(b) Force per unit charge
(c) Voltage per unit current
(d) None of these

(Konkan Railway TA 2017)

Ans : (b) Electric field is defined as force per unit distance i.e.

$$\boxed{\vec{E} = \frac{\vec{F}}{q}}$$

It is a vector quantity and it unit is Newton/coulomb.
where E = Electric field strength
F = Force
q = Charge
It unit is also volt/meter.

$$E = -\frac{dv}{dx} \text{volt/meter.}$$

89. The device which does not have frequency dependent properties on its own is
(a) Inductor (b) capacitor
(c) Resistor (d) All the above

(RRB Gorakhpur SSE 25.10.2009)

Ans : (c) Resistance is free from frequency. There is not effect of frequency on the resistance.
■ While capacitor and inductor is depended on frequency i.e. frequency effects the capacitor and inductor reactance.

$$X_C = \frac{1}{2\pi fc}$$

$$X_L = 2\pi fL$$

It is clear from above expression in capacitor, on increasing frequency X_C is decreases while in inductor, X_L is increases but there is no effect on resistance.

90. A pellet carrying a charge of 0.5C is accelerated from rest through a p.d. of 2000V,it attains K.E. of-
(a) 1000J (b) 1000 KW-hr
(c) 1000eV (d) zero

(RRB Mumbai C&G SSE 25.10.2009)

Ans. : (a) Given, V= 2000V and q = 0.5C

$$\text{Potential difference (V)} = \frac{\text{W(kinetic energy)}}{\text{Q(charge)}}$$

$$2000 = \frac{W}{0.5}$$

W= 2000 × 0.5

$$\boxed{W = 1000\ joules}$$

91. A conductor carries a current of 4 A and if magnitude of charge of an electron e = 1.6×10^{-19} Coulomb, then the number of electrons which flow through the cross section per sec is

(a) 2.5×10^{19} (b) 1.6×10^{19}
(c) 6.4×10^{19} (d) 0.4×10^{19}

(RRB Allahabad SSE 09.09.2012)

Ans : (a) Current (I) = 4A
Charge of an electron (e) = 1.6×10^{-19}C
time(t) = 1sec

Formula− $i=\frac{q}{t}$

q = ne

$\Rightarrow \quad i=\frac{ne}{t}$

$\Rightarrow \quad 4=\frac{n\times1.6\times10^{-19}}{1}$

$\Rightarrow \quad n=\frac{4}{1.6\times10^{-19}}$

$=2.5\times10^{19}$

92. Joule/Coulomb is the unit of
(a) electric field potential
(b) potential
(c) charge
(d) none of these

(RRB Allahabad SSE 09.09.2012)

Ans : (b) Joule/Coulomb is the unit of potential.

$$V=\frac{W}{q}=\frac{\text{joule}}{\text{coulomb}}=\text{volt}$$

Potential difference of one volt exists between if one joule of work is done in shifting a charge of one coulomb from one point to the other.

93. One Watt hour contains _____Joules
(a) 3.6×10^{8} (b) 3.6×10^{5}
(c) 3.6×10^{3} (d) 3.6×10^{-1}

(RRB Mumbai C&G SSE 25.10.2009)

Ans : (c) One watt hour contains 3.6×10^{3} joules

one watt hour = $\frac{1\,\text{joules}}{\text{second}}\times60\times60\,\text{second}$
= 3600 Joule
= 3.6×10^{3} Joule

94. A kilowatt hour is the unit of
(a) energy (b) power
(c) electrolyte (d) electric current

(RRB Allahabad JE 19.12.2010)

Ans : (a) A kilowatt is the unit of energy.
1 kilowatt hour = 1000 watt × 1 hour
= 1000 × 3600 watt-second
1 kWh = 36×10^{5} watt-second

95. The force between two point charges of 1C each separated by a distance 3m in free space is
(a) 9×10^{9} N (b) 9×10^{-9} N
(c) 3×10^{9} N (d) 10^{9} N

(RRB Chandigarh SSE 25.10.2009)

Ans : (d) Given, $q_1=q_2=q=1C$
r = 3 meter

$$F=\frac{1}{4\pi\varepsilon_0}\times\frac{q_1q_2}{r^2}$$

where, $\frac{1}{4\pi\varepsilon_0}=9\times10^{9}$

$F=\frac{q^2}{r^2}\times9\times10^{9}$

$F=\frac{1}{9}\times9\times10^{9}$

$F=10^{9}$N

96. Current always flow in direction :
(a) Opposite to that of Electron
(b) Direction same as of electron
(c) Independent of electron flow
(d) None of these

(RRB Mumbai JE 05.10.2008)

Ans : (a) Current always flow in direction opposite to that of Electron.
Current is defined as rate of flow of charge

$$\boxed{i=q/t}$$

And value of charge is equal to the product of number of electron and present charge on its.

$$\boxed{q=ne}$$

$e=1.6\times10^{-19}$ C
n = No. of Electron

97. Match List I with List II and select the correct answer using given lists

List-I	List-II
A. Ohm's law	1. Capacitors
B. Fleming's Right Hand Rule	2. Generator
C. Alternator	3. Voltage-current relation
D. Coulomb's Law	4. AC generator

(a) A-2, B-3, C-4, D-1
(b) A-1, B-2, C-3, D-4
(c) A-2, B-4, C-3, D-1
(d) A-3, B-2, C-4, D-1

(RRB Mumbai SSE 05.10.2008)

Ans : (d) The correct matching are given following-
1− Ohm's law is relation between voltage and current.
2− Fleming's right hand rule is used in generator.
3−Alternator is an AC generator.
4− Coulomb's law is for the capacitor.

98. If ten resistances of 10 ohms each are connected in parallel, the total resistance will be :
(a) 100 Ohm (b) Less than 100 Ohm
(c) 1 Ohm (d) None of these

(DMRC 2015)

Ans : (c) In parallel, when all resistance value same-

Equivalent resistance = $\frac{\text{R (value of resistance)}}{\text{n (Number of resistance)}}$

$R_{eq}=\frac{10}{10}=1\Omega$

99. Unit of resistivity is :
(a) Ω meter (b) mho metre
(c) mho (d) Ω

(LMRC 2015)

Ans : (a) Unit of resistivity is Ω meter.
From formula-

$$R=\rho\frac{\ell}{a}$$

R = Ω

ℓ = m

a = m^2

ρ = ?

$$\rho = \frac{Ra}{\ell} = \frac{\Omega m^2}{m}$$

$$\boxed{\rho = \Omega m}$$

■ mho is the unit of conductance which is called Siemens.

100. The material to be used in the manufacture of a standard resistor should be of

(a) low resistivity
(b) high resistivity and low temperature coefficient
(c) high temperature coefficient
(d) low resistivity and high temperature coefficient

(Konkan Railway TA 2017)

Ans : (b) The material to be used in the manufacture of a standard resistor should be of high resistivity and low temperature coefficient i.e. on increasing temperature changed in its resistance is very negligible.

101. Two wires A and B of the same material but of different lengths L and 2L have the radius r and 2r respectively. The ratio of specific resistance will be

(a) 1 : 4 (b) 1 : 8
(c) 1 : 1 (d) 1 : 2

(RRB Mumbai C&G SSE 25.10.2009)

Ans : (c) Resistivity is the property of the material that opposes the flow of charge or the flow of electric current. The unit of resistivity is ohm-meter which is depended on the composition of material and temperature, not at the length and cross-sectional area of material. So the ratio of resistivity of same material is same and resistance will be changed i.e. $\rho_1 : \rho_2 = 1 : 1$

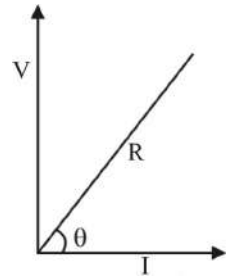
102. The curve representing Ohm's law is :

(a) Linear (b) Hyperbolic
(c) Parabolic (d) Triangular

(RRB Allahabad SSE 09.09.2012)

Ans : (a) The curve representing ohm's law is linear because

$$\frac{V}{I} = K = R \Rightarrow \uparrow V = \uparrow IR \quad \text{(linear)}$$



103. Specific resistance of a conductor depends upon :

(a) Dimension of the conductor
(b) Composition of conductor material
(c) Resistance of the conductor
(d) Both (a) and (b)

Ans : (b) Specific resistance of a conductor depends upon composition of conductor material and temperature.

Resistivity–Resistivity is a material property of the conductor. It depends only on the temperature of the conductor and not on the length or density of material. Increasing the length increases the resistance of the conductor but not the resistivity.

$$\rho = \frac{RA}{\ell}\Omega - m$$

104. A light bulb draws 300 mA when the voltage across it is 240 V. The resistance of the light bulb is

(a) 400 Ohms (b) 600 Ohms
(c) 800 Ohms (d) 1000 Ohms

RRB Chandigarh SSE 09.09.2012

Ans : (c) We know that,

$$R = \frac{V}{I} = \frac{240}{300\times10^{-3}} = \frac{24}{30\times10^{-3}} = 800\ \Omega$$

105. Which particle act as a current carrier in a metallic conductor?

(a) Only electrons
(b) Only ions
(c) Electrons and defect electrons
(d) Electrons and ions

(RRB Allahabad JE 19.12.2010)

Ans : (a) Only electron is a particle which is act as a current carrier in a metallic conductor. There are two type of velocity present in electron particle, one is spin velocity and other is orbital velocity.

■ One electron has -1.6×10^{-19} C charge.
■ Electron mass has 9.1×10^{-31} kg

106. Which of the following is the description of largest size resistor? (given that the material used in each is same)

(a) 100 Ω, 20 Watts (b) 10 Ω, 100 Watts
(c) 1K Ω, $\frac{1}{2}$ Watts (d) 1M Ω, $\frac{1}{4}$ Watts

(RRB Gorakhpur SSE 25.10.2009)

Ans : (b) Wattage Rating of a resistance is more than its will be in large size of a resistance wattage rating is more than it creates more power losses. So its size kept large to reduce the heat.

So resistance of 10 Ω, 100 watt size will be largest in all of them.

■ Power dissipated in resistance

$$P = \frac{V^2}{R} \text{ or } P \propto \frac{1}{R}$$

107. A thermistor has _____ temperature coefficient of resistance

(a) Positive (b) Zero
(c) Negative (d) any of the above

(RRB Chandigarh SSE 25.10.2009)

Ans : (c) A thermistor has Negative temperature coefficient of resistance.

■ On increasing temperature which material resistance increases then its temperature co-efficient is to be positive. E.g. conductive material, metal.

■ On increasing temperature which material resistance is decrease, then its temperature co-efficient is to be negative.

■ On increasing temperature which material resistance does not change i.e. higher increases nor decreases then its temperature co-efficient is to be very low.

E.g. - Eureka, magnine, constantan etc.

108. The filament of an electric bulb is made up of tungsten because
(a) It is cheaper
(b) It is brighter
(c) Its melting point is high
(d) Its resistance is low

(RRB Allahabad JE 19.12.2010)

Ans : (c) Use of tungsten in the form of filament because its melting points is high and temperature co-efficient is low.
■ Its melting point is 3422ºC.
■ The temperature co-efficient of resistance of tungsten is 4.5×10^{-3}ºC.

109. Which of the following is an essential condition for the transfer of heat from one body to another by means of conduction?
(a) Both the bodies must be at the same temperature
(b) Both the bodies must be metallic
(c) One of the bodies must be a metal
(d) Both the bodies must be at different temperatures

(RRB Allahabad SSE 09.09.2012)

Ans : (d) Both the bodies must be at different temperatures for the transfer of heat from one body to another by means of conduction.
There are three main ways that heat energy moves from one place to another place.
(i) Conduction–Conduction is the process by which heat energy is transmitted through collisions between neighbouring atoms or molecules. Conduction occurs more readily in solids and liquids, where the particles are closer together than in gases, where particles are further apart.
(ii) Convection–Convention is defined as the movement of fluid molecules from higher temperature regions to lower temperature regions.
(iii) Radiation–Thermal radiations are reffered to as radiant heat. Thermal radiation is generated by the emission of electromagnetic waves. These waves carry away the energy from the emitting body.

110. A current of 18 A flows through a conductor for half a minute. The total charge flown within the conductor in the same time was–
(a) 724 C (b) 90 C
(c) 540 C (d) 9 C

(RRB Mumbai JE 05.10.2008)

Ans : (c) Current (I) = 18 A
Time = 30 second
Charge of conductor (q) = Current × time
$q = 18 \times 30$
$q = 540$ C

111. What is the SI unit of the absolute permittivity of a medium?
(a) $\frac{1}{C}$ (b) $\frac{C^2}{(Nm^2)}$
(c) $\frac{C^2}{(Nm)}$ (d) $\frac{(Nm)}{C^2}$

(RRB 2014)

Ans : (b) SI unit of the absolute permittivity of a medium will be $\frac{C^2}{(Nm^2)}$.

$$F = \frac{1}{4\pi\varepsilon_0\varepsilon_r}.\frac{Q_1.Q_2}{d^2}$$

$$\varepsilon_0 \propto \frac{Q_1.Q_2}{Fd^2} \Rightarrow \varepsilon_0 = \frac{(C)^2}{N.m^2}$$

$\varepsilon_0 = 8.854 \times 10^{-12}$ F/m

112. Which of the following materials has the highest value of dielectric constant?
(a) ceramics (b) oil
(c) glass (d) vacuum

(Konkan Railway TA 2017)

Ans : (a) Ceramics has the highest value of dielectric constant among them.

S.N.	Dielectric material	Dielectric constant (ε_r)	Dielectric strength (kV/cm)
1.	Air	1	30
2.	Paper	2	400
3.	Paraffin	2.25	350
4.	Mica	6	500
5.	Glass	8	1000

113. The surface integral of the normal component of the electric displacement D over any closed surface equals the charge enclosed by that surface. This statement is associated with
(a) Faraday's law (b) Gauss's law
(c) Lenz's law (d) Kirchhoff's law

(RRB Gorakhpur SSE 25.10.2009)

Ans : (b) This statement is associated with Gauss's law.
According to Gauss law–The surface integral of the normal component of electric intensity E over a closed surface is equal to $1/\varepsilon_0$ times the total charge inside it mathematically,

$$\oint \vec{E}.\overrightarrow{dA} = \frac{q}{\varepsilon_0}$$

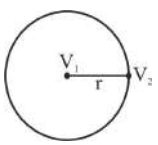
where sign $\oint$ denotes integration around whole of the closed surface.
■ The value of flux is depends on charge inside the closed surface.

114. The potential inside a charged hollow sphere is
(a) Zero
(b) Same as that on the surface
(c) Less than that on the surface
(d) None of the above

(RRB Mumbai SSE 05.10.2008)

Ans : (b) The potential inside a charged hollow sphere is same as that on the surface potential.
■ Potential difference inside a charged hallow sphere is zero because inside sphere charge (Q) and electric field intensity (E) is zero.

$$E = -\frac{dv}{dr}$$



$\because E = 0$ then $dv = 0$
dv = potential difference
$V_1 - V_2 = 0$, $V_1 = V_2$
where, V_1 = potential inside the charge hollow sphere
V_2 = potential at the surface
Potential the surface

$$\left[V = \frac{Q}{4\pi\varepsilon_0 R}\right]$$

115. How can we measure the battery capacity in SI units?

(a) Wh (b) Ah (c) KWh (d) Vh

Ans : (b) We measure the battery capacity in SI unit ampere hour. Sometimes abbreviated as Ah.

Ampere hour (Ah) = Current (I) × Discharge time (T)

■ Efficiency of battery in ampere hour.

$$\eta_{AH}\% = \frac{\text{Discharging ampere} \times \text{hour}}{\text{Charging ampere} \times \text{hour}} \times 100$$

For lead acid battery

$\eta_{AH}\% = 90 - 95\%$

116. Drift velocity acquired per unit electric field applied is called as :

(a) Relaxation time (b) Current density

(c) Potential difference (d) Electron mobility

(RRB Gorakhpur SSE 25.10.2009)

Ans : (d) Mobility (μ) is defined as the magnitude a drift velocity (V_d) per unit electric field E.

$$\mu = \frac{|V_d|}{E}.$$

■ Tts SI unit is $m^2/V\text{-}S$.

117. Which of the following is the dimensional formula of conductance?

(a) $M^1L^2T^{-3}I^{-1}$ (b) $M^1L^{-2}T^{-3}I^{-2}$

(c) $M^{-1}L^{-2}T^3I^2$ (d) $M^1L^1T^{-3}I^1$

(RRB Allahabad JE 19.12.2010)

Ans : (c)

Dimensional formula of conductance is $M^{-1}L^{-2}T^3I^2$

$$\text{Conductance} = \frac{1}{R}$$

$$= \frac{1}{\frac{V}{I}} \qquad [\because V = IR] \quad = \frac{I}{V}$$

$$= \frac{I}{\frac{W}{q}} \qquad \left[\because V = \frac{W}{q}\right]$$

$$= \frac{Iq}{W}$$

$$= \frac{I^2t}{W} \qquad [\because q = It]$$

$$= \frac{I^2T}{ML^2T^{-2}}$$

$$\boxed{\text{Conductance} = M^{-1}L^{-2}T^3I^2}$$

118. Which one of the following statement is TRUE about the resistance of a conductor?

(a) The resistance of a conductor is inversely proportional to the length of the conductor.

(b) The resistance of a conductor is directly proportional to the area of the conductor

(c) The resistance of a conductor is inversely proportional to the pressure applied on the conductor.

(d) The resistance of a conductor is inversely proportional to the area of the conductor.

(RRB Jammu JE 25.10.2009)

Ans : (d) The resistance of a conductor is inversely proportional to the area of the conductor and directly proportioal to the length of the conductor.

$$\boxed{R = \rho\frac{\ell}{A}\Omega}$$

where, ρ = specific resistance

ℓ = length of conductor

A = cross-sectional area of conductor

119. In parallel combination of resistance, the voltage is.....

(a) lower across largest resistance

(b) higher across largest resistance

(c) same across each resistance

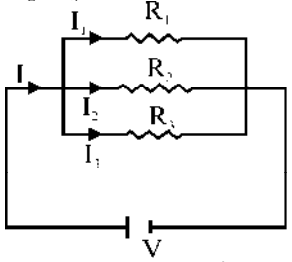
(d) higher across smaller resistance

(RRB Chandigarh SSE 25.10.2009)

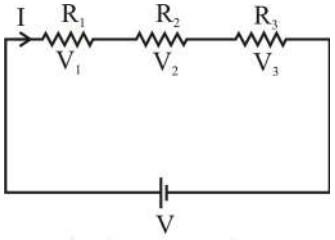
Ans : (c) In parallel combination of resistance, the voltage is same across each resistance and in series combination of resistance, the current is same in each resistance while voltage is different in each.

$V_1 = V_2 = V_3 = V$

$I = I_1 + I_2 + I_3$



Parallel connection



Series connection

$V = V_1 + V_2 + V_3$

120. Determine the heat (in joules) dissipated through a resistor of 15 ohms resistance, when 0.5 A of current is flowing through the resistor for 8 seconds.

(a) 40 (b) 30

(c) 20 (d) 60

(RRB Mumbai JE 05.10.2008)

Ans : (b) Given,

Current (I) = 0.5 Amp.

Time (t) = 8 second

Resistance (R) = 15 Ω

Dissipated heat (H) = $I^2Rt = 0.5 \times 0.5 \times 15 \times 8$

$H = 0.25 \times 120$

H= 30 joules

121. At 20 degree Celsius, aluminium wire has a resistance of 30 ohms. The temperature coefficient of resistance is 0.00305 per degree Celsius. What is the approximate resistance of the wire (in ohms) at 30 degree Celsius ?

(a) 28 (b) 31
(c) 35 (d) 45

(RRB Mumbai C&G SSE 25.10.2009)

Ans : (b) Resistance of Al at $20^oC = 30\Omega = R_{t_1}$

Temperature coefficient of resistance (α_0) = 0.00305 per degree Celsius

$$R_{t_2} = R_{t_1}(1 + \alpha_0\Delta t)$$

$$\left(\because \Delta t = t_2 - t_1 = 30 - 20^oC = 10^oC\right)$$

$$R_{30^o} = 30(1 + 0.00305 \times 10)$$

$$R_{30^o} = 30(1 + 0.0305)$$

$$= 30(1.0305)$$

$$R_{30^o} = 31\,\Omega$$

122. On which supply does the appliances based on heating effect of electric current work ?

(a) AC (b) DC
(c) Both AC and DC (d) None of these

(RRB Allahabad SSE 09.09.2012)

Ans : (c) The appliances based on heating effect of electric current works on both AC and DC. For example–electric heater is based on the heating effect and we use AC and DC both in the electric heater.
Electric oven is also works on AC and DC both.
Joule's equation of electrical heating

$$\boxed{\text{Heat}(H) = I^2Rt}$$

Where,
I = current, R = resistance, t = time

123. What will be the resistance (in ohms) of a resistor, when the current through the resistor is 2 A and the potential difference between the ends of the resistor is 40 V?

(a) 20 (b) 10
(c) 30 (d) 40

(RRB Jammu JE 25.10.2009)

Ans : (a) Given–Current (I) = 2 A
Voltage (V) = 40 volt

$$\text{Resistance (R)} = \frac{V}{I}$$

$$R = \frac{40}{2} = 20\Omega$$

124. A factory runs in 4 shifts of 6 hours each, in which it consumes 36 kW, 86kW, 50 kW and 20 kW in each shift respectively. Calculate the energy (in kWh) consumed by the factory per day.

(a) 216 (b) 557
(c) 1152 (d) 1920

(RRB Chandigarh SSE 25.10.2009)

Ans : (c) Total power = 36 + 86 + 50 + 20 = 192 kW
Energy consumed = 192×6

$$\boxed{= 1152 \text{ kWh}}$$

125. Which one of the following statement is TRUE?

(a) The equivalent resistance in series combination is larger than the largest resistance in the combination
(b) The equivalent resistance in series combination is smaller than the largest resistance in the combination
(c) The equivalent resistance in series combination is equal to the smallest resistance in the combination
(d) The equivalent resistance in series combination is equal to the largest resistance in the combination

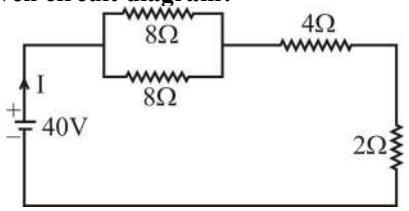
Ans : (a) The equivalent resistance in series combination is larger than the largest resistance in the combination because in series combination all resistance connected directly.

$$\boxed{R_{eq} = R_1 + R_2 + R_3 + ...}$$

While in parallel combination is opposite of series connection. In this the equivalent value is lesser than the lowest resistance because

$$\boxed{\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + ...}$$

126. What will be the value of current 'I' (in A) for the given circuit diagram?



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

Ans : (b) Equivalent Resistance (R_{eq}) = (8||8)+4+2

$$\Rightarrow \quad \frac{8 \times 8}{8 + 8} + 4 + 2 = 4 + 4 + 2 = 10\Omega$$

$$R_{eq} = 10\Omega$$

$$I = \frac{V}{R} = \frac{40}{10} = 4\text{Amp}$$

$$I = 4\text{Amp}$$

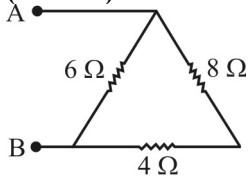
127. The internal resistance of an ideal current source is.....

(a) Zero (b) One
(c) Negative (d) Infinite

(RRB Gorakhpur SSE 09.09.2012)

Ans. (d) : The internal resistance of an ideal current source is infinite.
■ Internal resistance of ideal voltage source is zero.

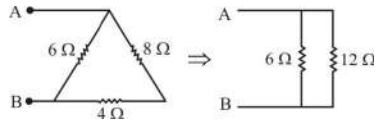
128. In the figure shown below, the equivalent resistance (in ohms) across terminals A-B is.....



(a) 2 (b) 4
(c) 12 (d) 18

(RRB Mumbai C&G SSE 25.10.2009)

Ans. (b) :



8Ω and 4Ω is in series

$$R_{eq} = 4 + 8 = 12\Omega$$

$$R_{AB} = \frac{6 \times 12}{6 + 12} = \frac{72}{18} = 4$$

$$\boxed{R_{AB} = 4\Omega}$$

129. A hot wire supplies 100 kJ in 10 minutes. What is the potential difference (in V) across the wire, when the current is 2 A?

(a) 80.33 (b) 83.33
(c) 85.33 (d) 88.33

(RRB Jammu JE 25.10.2009)

Ans. (b) : Given,

$I = 2\,Amp$

$H = E = 100 \times 10^3$ Joule

$t = 10$ minutes $(10 \times 60$ sec$)$

$$P = \frac{H}{t}$$

$$\begin{cases} P = VI \\ H = VIt \\ H = E = Pt \\ P = \frac{H}{t} \end{cases}$$

$$P = \frac{100 \times 10^3}{10 \times 60} = \frac{1000}{6} = \frac{500}{3} \text{ watt.}$$

$$V = \frac{P}{I}, \qquad V = \frac{500}{3 \times 2} = \frac{250}{3} = 83.33 \text{ volt}$$

$$\boxed{V = 83.33\,volt}$$

130. Calculate the value of maximum safe current (in A) that can flow in a 50 Ohms, 4 W resistor.

(a) 0.28 (b) 1.28
(c) 2.28 (d) 3.28

(RRB Bhopal SSE 09.09.2012)

Ans. (a) : Given, $R = 50\Omega$, $P = 4W$, $i = ?$

$$P = i^2R$$

$$i^2 = \frac{P}{R} = \frac{4}{50} = \frac{1}{12.5} = \frac{10}{125}$$

$$i = \sqrt{\frac{10}{125}} = \sqrt{\frac{10}{5 \times 5 \times 5}} = \frac{1}{5}\sqrt{\frac{10}{5}}$$

$$= \frac{\sqrt{2}}{5} = \frac{1.414}{5} = 0.28$$

$$\boxed{i = 0.28\,Amp}$$

131. The relationship between Electrical Power and current is.....

(a) linear (b) non-linear
(c) constant (d) exponential

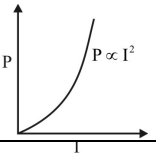
(RRB Mumbai JE 05.10.2008)

Ans. (b) : The relation between electric power and electric current is non-linear.

Because-

$$P = I^2R$$

$$\boxed{P \propto I^2}$$



132. Which of the following is an active element in a circuit?

(a) Current source (b) Resistance
(c) Inductor (d) Capacitance

(RRB Chandigarh SSE 25.10.2009)
(RRB Mumbai JE 05.10.2008)

Ans : (a) Current source is an active element.

Active Element–That element which supply the energy to the circuit is called active element. E.g. voltage source, current source, battery, transistor etc.

Passive Element-That element which absorb the energy or store the energy or converts in heat is called passive element. E.g. - Resistor, Inductor, Capacitor.

- Capacitor stores energy in electric field.
- Inductor stores energy in magnetic field.
- Resistance converts electric energy into heat.

133. Which of the following is the Curie temperature (in Kelvin) of Iron (Fe)?

(a) 948 (b) 713
(c) 1043 (d) 858

(RRB Jammu JE 25.10.2009)

Ans : (c) The curie temperature (in Kelvin) of iron is 1043K and 770 in Celsius.

Curie temperature–The temperature at which a ferromagnetic material becomes paramagnetic in nature. A magnetic material completely losses its magnetic property at curie temperature.

According to Curie's law–

i.e. $\boxed{X = \frac{C}{T}}$ where, C = curie's constant

134. What is the critical temperature (in Kelvin) for Lead below which it shows superconductivity?

(a) 0.8 (b) 1.2
(c) 4.2 (d) 7.2

(RRB Jammu SSE 09.09.2012)

Ans : (d) 7.2K is the critical temperature (in Kelvin) for lead below 7.2 K lead shows superconductivity.

Superconductivity–It is a phenomenon occurring in certain materials generally at very low temperature, characterized by exactly zero electrical resistance and the exclusion of the interior magnetic field.

- In simple word for some materials, the resistivity vanishes at some low temperature, they become superconducting, such materials are called superconductors.

135. Which of the following terms is analogous to conductivity?

(a) Inductance (b) Permeability
(c) Retentivity (d) Resistivity

(RRB Allahabad JE 09.09.2012)

Ans. (b) : Conductivity is analogous to permeability. Conductivity is the property of electric circuit and its unit is mho/meter. While permeability is the property of magnetic circuit and its unit is henry/meter.

- Permeability shows in a material, how many flux flowing in that material in comparison to air.

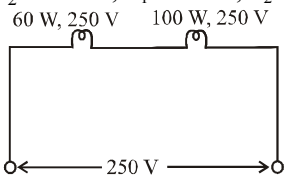
136. Two bulbs of rating 60 W, 250 V and 100 W, 250 V are connected in series across a supply of 250 V in a room. What will be the total power dissipation in the circuit?

(a) 37.5 W (b) 60.0 W
(c) 100.0 W (d) 160.0 W

(RRB Bhubneshwar JE II 29.11.2008)

Ans. (a) : Given–

$V_1 = V_2 = 250V$, $P_1 = 60$ W, $P_2 = 100$ W



Note– When two bulb are connected in series and voltage rating of them is same then to calculate the total power of circuit following formula is used.

$$P_{eq} = \frac{P_1 \times P_2}{P_1 + P_2}$$

$$P_{eq} = \frac{60 \times 100}{160} = 37.5 \text{ Watt}$$

Note–If voltage rating of both bulb is not same then this formula is not used.

137. Two bulbs with power 500W and 200W respectively, and rated at 250V, will have the resistance ratio as:

(a) 5 : 2 (b) 2 : 5
(c) 25 : 4 (d) 4 : 25

RRB Bhopal Section Engineer, 24.11.2002

Ans. (b) : Given–

$P_1 = 500W$

$P_2 = 200W$

$V_1 = V_2 = V = 250V$

$\because \quad R = \frac{V^2}{P} \Rightarrow \therefore R_1 = \frac{V^2}{P_1}$

and $R_2 = \frac{V^2}{P_2}$

$$\frac{R_1}{R_2} = \frac{P_2}{P_1} \times \left(\frac{V_1}{V_2}\right)^2 \Rightarrow \frac{R_1}{R_2} = \frac{200}{500}$$

$R_1 : R_2 = 2:5$

138. If the length of a cable is doubled, then its insulation resistance will:

(a) increase by 50% (b) reduce by 25%
(c) reduce by 50% (d) increase by 25%

RRB Bangalore Section Engineer 01.02.2009

Ans. (c) : formula – $R = \frac{\rho}{2\pi\ell} \log_e \frac{r_2}{r_1}$

$$R \propto \frac{1}{\ell}$$

Given– $\ell_1 = \ell, \quad \ell_2 = 2\ell$

$$\frac{R_1}{R_2} = \frac{\ell_2}{\ell_1} \Rightarrow \frac{R_1}{R_2} = \frac{2\ell}{\ell}$$

$$\frac{R_1}{R_2} = 2$$

$R_2 = 0.5\ R_1$

$R_2 = 50\%\ R_1$

139. A 3Ω resistor with 2A current will dissipate power of:

(a) 4 W (b) 3 W
(c) 12 W (d) 8 W

RRB Chennai Section Engineer, 12.02.2012

Ans. (c)

formula – $P = i^2R$

Given–

$R = 3\Omega$

$i = 2A$

$P = (2)^2 \times 3 = 4 \times 3$

$P = 12W$

140. The resistance of a wire is 6Ω if the length of the same wire is increased 3 times and cross-sectional area is increased 2 time, then the resistance of wire will become.

(a) 3 Ω (b) 9 Ω (c) 12 Ω (d) 36 Ω

RRB Chandigarh Section Engineer, 26.02.2012

Ans. (b) : Given–

$\rho_1 = \rho_2 = \rho$

$\ell = \ell_1, \quad \ell_2 = 3\ell$

$a_1 = a \quad a_2 = 2a$

$R_1 = 6\Omega \quad R_2 = ?$

Formula – $R = \rho\frac{\ell}{a}$

$$\frac{R_1}{R_2} = \frac{\rho_1}{\rho_2} \times \frac{\ell_1}{\ell_2} \times \frac{a_2}{a_1}$$

Putting the value–

$$\frac{6}{R_2} = \frac{\rho}{\rho} \times \frac{\ell}{3\ell} \times \frac{2a}{a}$$

$$R_2 = \frac{6 \times 3}{2}$$

$R_2 = 9\Omega$

141. Electric resistance offers ------- to the flow of current.

(a) conductance (b) voltage
(c) opposition (d) a path

(RRB Chandigarh SSE 25.10.2009)

Ans. (c) : Electric resistance offers opposition to the flow of current.

The formula to calculate the resistance using ohm's law is given as follows–

$$R = \frac{V}{I}$$

Where, R is the resistance of the resistor in ohm, V is the voltage drop in the resistor in volts.

142. A 240V, 60W lamp has a working resistance of:

(a) 1,400 Ω (b) 60 Ω
(c) 690 Ω (d) 960 Ω

RRB Jammu Section Eng, 2013

Ans. (d) Given– $V = 240V, \quad P = 60W$

$\because \quad R = \frac{V^2}{P}$

$$R = \frac{(240)^2}{60} = \frac{240 \times 240}{60}$$

$R = 960\Omega$

143. Calculate the maximum safe current that can pass through a 1.8 kΩ resistor rated at 0.5 W.

(a) 0.16 mA (b) 16 mA
(c) 16 μA (d) 16 A

RRB Ranchi Signal Maintainer Group-III, 20.11.2005

Ans. (b) Given− P = 0.5W

$R = 1.8k\Omega = 1800\Omega$

Formula−

$P = i^2R$

$$\Rightarrow \quad i = \sqrt{\frac{P}{R}} = \sqrt{\frac{0.5}{1800}}$$

$$= \sqrt{\frac{5}{18000}} = \frac{1}{60}A = 16.67mA \approx 16mA$$

$= 16$ mA

144. A heater draws a current of 7A from a 230 V source for 12h. Calculate energy consumption in kWh.

(a) 19.32 kWh (b) 2.76 kWh
(c) 38.64 kWh (d) 1.61 kWh

(RRB Mumbai C&G SSE 11.10.2010)

Ans : (a) Given,

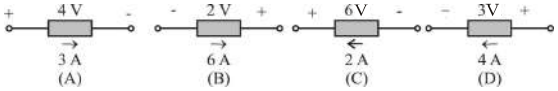
t = 12 h, V = 230 V, I = 7A

Formula− E = VIt

$= 230 \times 7 \times 12 = 19320$ Wh

Consumed energy (E) = 19.32 kWh

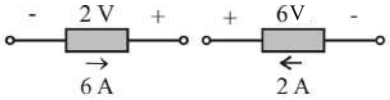
145. Which of the following supplies 12 W?



(a) A, C (b) C, D
(c) A, B (d) B, C

RRB Bangalore. 21.11.2004

Ans : (d) Figure B and C supplies 12W.



Current comes out through positive terminals of source and inters through negative terminals of source.

Hence B and C will behaves as a source. B and C both will supply 12 watt because current is flowing high voltage to low voltage.

146. The rate of doing work is called_____.

(a) energy (b) power
(c) current (d) voltage

(RRB Mumbai C&G SSE 25.10.2009)

Ans : (b) The rate of doing work is called power and is unit is watt.

$$\text{Power}(P) = \frac{\text{Work}(W)}{\text{Time}(t)}$$

$$P = \frac{W}{t} \text{ joules/second}$$

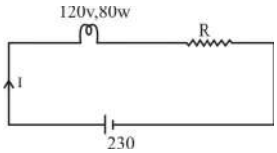
147. A filament lamp is rated 120V and 80 Watts. The value of series resistance required to operate this lamp on a 230V mains is_____.

(a) 180 Ω (b) 165 Ω
(c) 661 Ω (d) 151 Ω

(RRB Jammu JE 25.10.2009)

Ans : (b) Given, P = 80W, V = 120V

$$I = \frac{P}{V} \Rightarrow I = \frac{80}{120} \Rightarrow I = \frac{2}{3}A$$



V=voltage drop across lamp + Voltage drop across the resistance.

$$230 = 120 + \frac{2}{3} \times R$$

$$230 - 120 = \frac{2}{3} \times R$$

$$110 = \frac{2}{3} \times R$$

$$R = \frac{110 \times 3}{2}$$

$$\boxed{R = 165\Omega}$$

148. Two incandescent bulbs rated respectively as P_1 and P_2 for operation at a specified main voltage are connected in series across the mains. The total power supplied by the mains to the two bulbs will be:

(a) $\sqrt{(P_1^2 + P_2^2)}$ (b) $P_1 + P_2$
(c) $\sqrt{(P_1 \times P_2)}$ (d) $P_1P_2/(P_1 + P_2)$

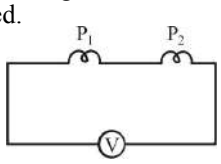
(RRB Jammu JE 25.10.2009)

Ans : (d) When two bulbs are connected in series and voltage rating of them is same then to calculate the total power drawn from supply following formula is used.

Supply power

$$\boxed{P = \frac{P_1P_2}{P_1 + P_2} W}$$

Note:- If voltage rating of both is not same then this formula is not used.

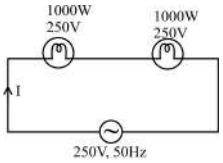


149. Two heaters rated at 1000W, 250 each are connected in series across a 250V, 50Hz ac mains. The total power drawn from the supply would be ..... watt.

(a) 1000 (b) 500
(c) 250 (d) 2000

RRB Bangalore. 21.11.2004

Ans : (b)



Resistance of lamp $\boxed{R = \frac{V^2}{P}}$

$$R = \frac{250 \times 250}{1000} \Rightarrow R = 62.5\Omega$$

Flow current in the circuit $= \frac{250}{62.5 + 62.5} = 2A$

Power (P)= VI = 250×2 = 500W

150. Which of the following does not have dual relationship?

(a) Current-Voltage
(b) Inductance-Capacitance
(c) Tie-set-Cut-Set
(d) Resistance-Reactance

RRB Patna/Allahabad ESM-II , 30.01.2011

Ans : (d) Resistance and reactance have not dual relationship

Element	Dual
Current	Voltage
Inductance	Capacitance
Tie-set	Cut-set
Resistance	Conductance
Reactance	Susceptance

■ A dual relationship exists between certain pairs of electric devices and units, e.g. voltage and current.

■ Duality manifests itself by the ability to interchange dual units in an expression, yielding two dual, different, yet valid expressions.

■ A dual expression is formed by interchanging the two and thus creating its corresponding dual rule.

■ Ultimate reason behind this is the duality of electrical and magnetic phenomena in nature.

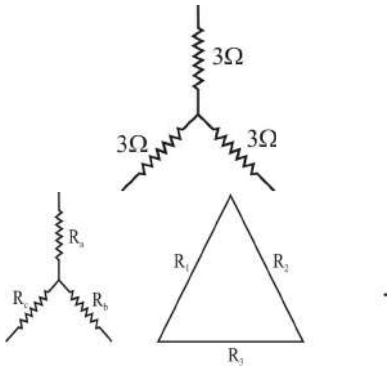
■ Example: $V(t) = L\frac{di}{dt} \Leftrightarrow i(t) = C\frac{dV}{dt}$.

151. If each branch of star connection is 3Ω. Then its corresponding delta connection will contain_____.

(a) 3Ω (b) 1/3Ω
(c) 9Ω (d) 1/9Ω

RRB Patna/Allahabad ESM-II , 30.01.2011

Ans : (c)



$$R_1 = \frac{R_aR_b + R_bR_c + R_cR_a}{R_b}$$

$$= \frac{3\times3 + 3\times3 + 3\times3}{3} = \frac{27}{3} = 9\Omega$$

152. The resistance of a conductor, when its temperature is increased_____:

(a) remains constant (b) decreases
(c) varies (d) increases

RRB Bangalore. 21.11.2004

Ans : (d) When increases temperature of conductor, then resistance of a conductor also increases.

■ We know that resistance of material depends upon temperature by the condition–

$$R_t = R_o(1 + \alpha\Delta T)$$

For conductor (metal) α is positive in nature. Hence, resistance of a conductor increases with increase in temperature.

153. Which of the following determines total power in a series circuit?

(a) Source voltage times the current
(b) Total voltage applied to the circuit
(c) Current flowing through a switch
(d) Average of the wattage consumed by each resistor

RRB Allahabad Junior Engineer-II, 08.01.2006

Ans : (a) Total power in a series circuit is given the current times of source voltage–

$$P_{total} = V_S \times I_S$$

V_S = source voltage

I_S = source current.

■ Its unit is watt.

■ Electric power is the rate at which electrical energy is transferred by an electric current.

154. A current of 5A flows through a conductor against a potential difference of 200V. The power dissipated will be.....

(a) 1000W (b) 1.1kW
(c) 2000W (d) 100W

(RRB Mumbai JE 05.10.2008)

Ans : (a) Potential difference (V) = 200Volt

Current (I) = 5Amp.

Power (P) = VI

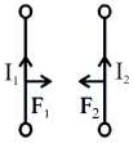
= 200×5 = 1000W

155. Two parallel conductors are carrying currents in the same direction. Which of the following statements is correct?

(a) There is a repelling force
(b) The force increases when the current is decreased
(c) There is an attracting force between the conductors
(d) The force increases when the distance between the conductors is increased

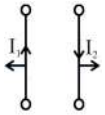
RRB Allahabad Junior Engineer-II, 08.01.2006

Ans : (c) Two parallel conductors attracts each other if when currents through them flow in the same directions.



Here, $F_1 = \frac{\mu_0 I_1 I_2}{2\pi d}.\ell = -F_2$

■ Two parallel conductors repel each other if the currents flow through them in the opposite directions



156. A voltage of 100V is applied to a circuit of resistance of 10Ω, the power dissipated (in watts) by the resistance will be____:

(a) 100 (b) 500
(c) 1000 (d) 1500

(RRB Chandigarh SSE 25.10.2009)

Ans : (c) Resistance (R) = 10 Ω
Voltage (V) = 100 V

$$\text{Current (i)} = \frac{V}{R} = \frac{100}{10} = 10\text{Amp}$$

$$\text{Power (P)} = i^2 R$$
$$= 10^2 \times 10$$
$$= 100 \times 10 = 1000 \text{ Watt.}$$

157. When an electric current flows through a conductor, its temperature rises. This is because of .....

(a) Mutual collisions between metal atoms
(b) Mutual collisions between conducting electrons
(c) Collisions between conduction electrons and atoms
(d) Release of conduction electrons from parent atoms

RRB Kolkata, 06.02.2005

Ans : (c) The electric current flowing through a conductor wire produces heating and increases its temperature because of collisions of the conduction electrons with the atoms of the conductor wire.
A conductor has a large number of free e^- in it. When a voltage difference is applied across the ends of a conductor wire, the free e^- begin to drift from the low voltag to the high voltage region. These e^- collide with the positive ions. In these collisions energy of the e^- is transferred to the positive ions and they begin to vibrate more violently. As a result, heat is produced and temperature increases.

158. For a voltage source.....

(a) Terminal voltage is equal to the source emf
(b) Terminal voltage cannot exceed the source emf
(c) Terminal voltage is always lower than source emf
(d) Terminal voltage is higher than the source emf

RRB Chennai Technical (Eng.), 15.04.2007

Ans : (b) Terminal voltage cannot exceed the source emf of a voltage source.
Voltage source–It is a two-terminal device which can maintain a fixed voltage. An ideal voltage source can maintain the fixed voltage independent of the load resistance or the output current.
■ A voltage source is the dual of current source.

159. In gases the flow of current is due to.....

(a) Electrons only
(b) Positive and negative ions
(c) Electrons, positive ions
(d) Electrons, positive ions and negative ions

RRB Bangalore Technical (Eng.), 22.04.2007

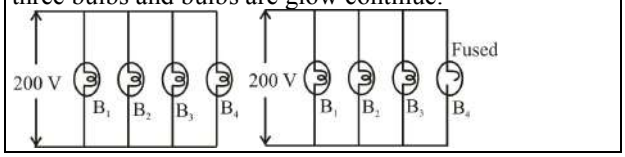
Ans : (d) In gases the flow of current is due to electrons, positive ions and negative ions.
■ Positive ions flow in one direction and negative ions flow in the opposite direction to make up current in gases and liquids.

160. Four 100 W bulbs are connected in parallel across 200V supply line. If one bulb gets fused.....

(a) No bulb will light
(b) All the four bulbs will light
(c) Rest of the three bulbs will light
(d) None of these

RRB Secunderabad Technical (Eng.), 20.05.2007

Ans : (c) If one bulb gets fused in parallel connection then other three bulb are glow continue because in parallel connection of bulb supply voltage is same for each so remaining other three bulb voltage across them constant and still the current will flow in the remaining three bulbs and bulbs are glow continue.



161. A 100 watt light bulb burns on a average of 10 hours a day for one week. The weekly consumption of energy will be.....

(a) 7 Unit (b) 70 Unit
(c) 0.7 Unit (d) 0.07 Unit

DMRC Secunderabad Section Eng. 29.06.2008

Ans : (a) A 100 watt light bulb glow in a day at for 10 hour for one week, then weekly consumption of energy will be 7 units.

P = 100watt t = 10 hour per day

$$E = \frac{100 \times 10 \times 7}{1000} = 7\text{Unit}$$

E = 7Unit
1Unit = 1 killo watt hour
Hence, weekly consumption of energy will be 7 units

162. Whenever current is supplied by a source its terminal voltage:

(a) Increases (b) Decreases
(c) Remain Constant (d) None of the above

DMRC Secunderabad Section Eng. 29.06.2008

Ans : (b) Whenever current is supplied by a source, this current also flows through the internal resistance connected in series in the source because of voltage drop across the internal resistance, the terminal voltage is decreased.

163. The current rating of a 5kΩ, 1/2W resistor is:

(a) 1A (b) 0.1
(c) 0.001 (d) 0.01

RRB Patna Technical Eng., 27.07.2008

Ans : (d) Given, $R = 5 \times 1000 = 5000\Omega$

$$P = \frac{1}{2}\text{watt}$$

Formula- $I = \sqrt{\frac{P}{R}}$

$$I = \sqrt{\frac{1}{2 \times 5000}}$$

$$I = 0.01\text{Amp}$$

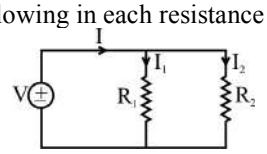
164. A circuit contains two unequal resistance in parallel, then:

(a) large current flows in larger value resistance
(b) current is same in both

(c) smaller current flows in smaller value resistance
(d) potential difference across each is same

RRB Chandigarh Section Eng. S15.03.2009

Ans : (d) Two unequal resistance connected in parallel then potential difference across each resistance is same and current is flowing in each resistance different.



Hence, in parallel $V = V_1 = V_2$
and $I_1 \neq I_2 \neq I$

165. The resistance/conductance of a material is a function of–
(a) Temperature
(b) Frequency
(c) Both temperature and frequency
(d) None of the other options

RRB Patna/Allahabad ESM-III, 30.01.2011

Ans : (c) The resistance and conductance of a material is a function of both temperature and frequency.
■ Conductance measures how easy it is for electric current to flow and is the inverse of resistance. It is measured in units of Siemens or Mho.

$$\text{Conductance}(S) = \frac{1}{\text{Resistance}(\Omega)}$$

■ The resistance of an object depends on temperature.
$R_t = R_o(1 + \alpha\Delta T)$
ΔT = change in temperature
α = Temperature co-efficient
■ Resistance in AC is greater than resistance in DC because skin effect and skin effects occurs due to frequency.

166. To determine the polarity of the voltage drop across a resistor, it is necessary to know.
(a) value of current through the resistor
(b) direction of current through the resistor
(c) value of resistor
(d) emf in the current

(RRB Malda SSE 25.10.2009)

Ans : (b) The polarity of the voltage drop across a resistor is determined by the direction of current flowing through it, positive entering and negative exiting.

$V = IR$ volt

167. Resistivity of copper is :
(a) Less than aluminium
(b) More than aluminium
(c) Equal to aluminium
(d) Exactly twice than aluminium

(RRB Mumbai JE 05.10.2008)

Ans : (a) Resistivity of copper is less than aluminium.
■ Number of free electron in copper is greater than the number of free e^- of aluminium. Hence conductivity of Cu is greater in comparison to Al, i.e. resistance of Al is more.

Materials	Specific Resistance (Ωm)
Copper	1.72×10^{-8}
Silver	1.59×10^{-8}
Gold	2.24×10^{-8}
Tungsten	5.65×10^{-8}
Aluminium	2.65×10^{-8}

168. To neglect a current source, the terminal across the sources are :
(a) Open–circuited
(b) Short–circuited
(c) Replaced by some resistance
(d) Replaced by capacitance

RRB Chandigarh Section Eng. 26.02.2012

Ans : (a) To neglect a current source, the terminal across the source is open-circuited because an ideal current source has infinite internal resistance which behaves like a open circuit.
■ While to neglect a voltage source, the terminal across the source are short-circuited because ideal voltage source has zero internal resistance and it is replaced by short circuited.

169. Which of the following is not the same as watt?
(a) Joule/sec. (b) $(\text{Ampere})^2 X$ ohm
(c) $(\text{Volt})^2/\text{ohm}$ (d) Volt/Ampere

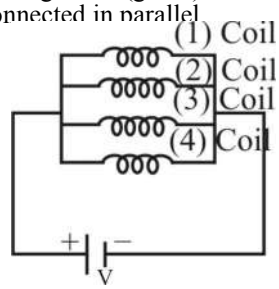
RRB Chandigarh Section Eng26.02.2012

Ans : (d) Power (p) = Voltage × Current
$p = V \times I$
$(V = IR)$
$p = IR \times I$
$p = I^2R$ $\quad (\text{Ampere})^2 \times \text{Ohm}$
$p = \frac{V^2}{R}$ $\quad (\text{Volt})^2/\text{Ohm}$
Hence, Energy (E) = I^2 Rt $\Rightarrow$ Power × Time
Joules (E) = Watt × Second
Watt = Joules/Second

170. For a given voltage, four heating coils will produce maximum heat, when–
(a) all are connected in parallel
(b) all are connected in series
(c) connected with two parallel pairs in series
(d) one pair is connected in parallel with the other two in series

(RRB Chandigarh SSE 25.10.2009)

Ans : (a) For a given voltage, four heating coils will produce maximum heat, when all are connected in parallel.
Suppose line voltage is V (given) and resistance of each coil R. If all connected in parallel



$$R_{eq} = \frac{R}{4}$$

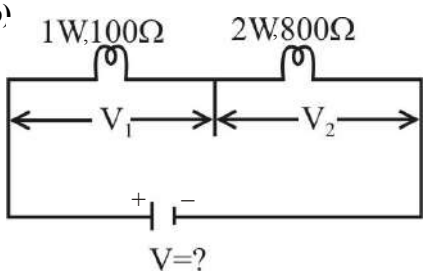
Then power will be $\frac{4V^2}{R}$ in parallel and in series power is $\frac{V^2}{4R}$.
Thus, we can say the maximum heat is produced when all connected in parallel.

171. A 100 Ω, 1 W resistor and an 800 Ω, 2 W resistor are connected in series. The maximum DC voltage that can be applied continuously to the series circuit without exceeding the power limit of any of the series resistors is–

(a) 90 V (b) 50 V
(c) 45 V (d) 40 V

(RRB Mumbai C&G JE 25.10.2009)

Ans : (b)



$P = \frac{V^2}{R}$ Watt

$V^2 = P.R$

$V_1^2 = 1 \times 100$

$V_1 = 10$ volt

$V_2^2 = 2 \times 800$

$V_2^2 = 1600$

$V_2 = 40$ volt

$V = V_1 + V_2$

$V = 40 + 10 = 50$ V

$V = 50$ volt

172. Two lamps of 100 W and 200W rated for 220 V are placed in series and a 440V applied across them, then:

(a) only 100W lamp will fuse
(b) only 200W lamp will fuse
(c) both lamps will fuse
(d) no lamps will fuse

(RRB Malda SSE 25.10.2009)

Ans : (a) $P_1 = 100$ W, $P_2 = 200$ W

$V = 220$ V

It is in series connection

$$R_1 = \frac{V^2}{P_1} = \frac{220 \times 220}{100} = 484\Omega$$

$$R_2 = \frac{V^2}{P_2} = \frac{220 \times 220}{200} = 242\Omega$$

$\because$ Both bulbs are connected in series and 440V applied across them then bulb will fused which resistance is high because it will produced heat more according to I^2R.

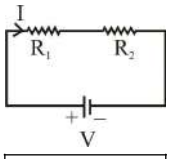
173. Two resisters are said to be connected in series unequally if.....

(a) both carry the same value of current
(b) Total current is equal to the sum of each branch of current
(c) same current passes in turn through both
(d) None of these

RRB Chandigarh Section Eng26.02.2012

Ans : (c) Two resistors are said to be connected in series unequally if same current passes through both resistors.

For series,



$R_{eq} = R_1 + R_2$

Here I will same for both resistor.

174. A 12V source has an internal resistance of 90Ω. If a load resistance of 20Ω is connected to the voltage source, the load power, P_L is–

(a) 2.38 mW (b) 2.38 W
(c) 238 mW (d) 23.8 W

RRB Chandigarh Section Eng26.02.2012

Ans : (c) Given, V = 12 volt, $R_s = 90\Omega$, $R_L = 20\Omega$

$$I = \frac{V}{R_S + R_L} = \frac{12}{90 + 20} = \frac{12}{110} = 0.10909 \text{ A}$$

Consumed power by load

$= I^2R_L = 0.10909 \times 0.10909 \times 20$

$= 0.1189 \times 2 \quad = 0.238$ watt

$P_L = 238\text{mW}$

Hence, value of consumed power by load will 238 mW.

175. The electric current is due to the flow of :

(a) positive charge only
(b) negative charge only
(c) both the charges
(d) neutral particles only

RRB Bangalore Section Eng. 01.02.2009

Ans : (c) The electric current is due to the flow of both the charges i.e. positive and negative both.

■ Current is flow in solid by electron (negative) and in liquid by the electron and ions both.

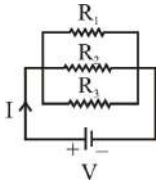
■ In intrinsic semiconductor both electrons and holes (positive) participate in conduction of current.

176. To determine the value of the net resistance (R) for three parallel resistor R_1, R_2, R_3, we can use the following equation

(a) $R = R_1 + R_2 + R_3$
(b) $R = 1/R_1 + 1/R_2 + 1/R_3$
(c) $1/R = 1/R_1 + 1/R_2 + 1/R_3$
(d) $1/R = R_1 + R_2 + R_3$

RRB Bangalore Section Eng. 01.02.2009

Ans : (c) To determined the value of net resistance (R) for three parallel resistor R_1, R_2, R_3 we can use the equation $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$



177. A 16mA current source has an internal resistance of 10k ohm. How much current will flow is a 2.5 K ohm load connected across its terminals

(a) 4.2 mA (b) 6 mA
(c) 11.5 mA (d) 12.8 mA

(RRB Mumbai C&G JE 25.10.2009)

Ans : (d) Given

$I = 16$ m Amp

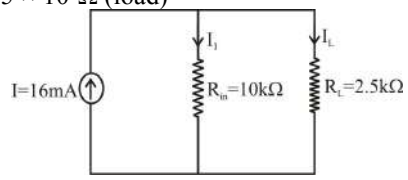
$I = 16 \times 10^{-3}$ Amp

$R_{in} = 10\ K\Omega$

$R_{in} = 10 \times 10^{3}\Omega$

$R_L = 2.5\ K\Omega$

$R_L = 2.5 \times 10^{3}\Omega$ (load)



From current divider rule, $(I_L) = I \dfrac{R_{in}}{R_{in} + R_L}$

$$I_L = 16 \times 10^{-3} \times \frac{10 \times 10^3}{12.5 \times 10^3}$$

$$I_L = \frac{160}{12.5} \times 10^{-3}$$

$I_L = 12.8$ mA

178. A 680 Ω load resistor R_L, is connected across a constant current source of 1.2A source resistance (R_S) is 12kΩ. The load current through R_L, is :

(a) 12A (b) 1.2A

(c) 114 mA (d) 1.14 A

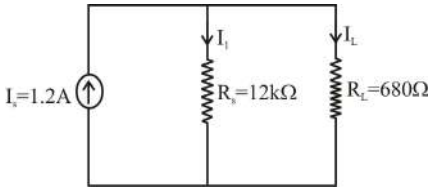
(RRB Mumbai JE 05.10.2008)

Ans : (d)

Load resistance = 680 Ω

Internal resistance = 12 KΩ

Source current = 1.2A



According to the current dividing rule–

$$I_L = I_s \times \left(\frac{R_s}{R_s + R_L} \right)$$

$$= 1.2 \times \left(\frac{12000}{12000 + 680} \right) = 1.2 \times \frac{12000}{12680}$$

$I_L = 1.14$A

179. The output resistance of a voltage source is 4 ohm. Its internal resistance will be :

(a) 4 ohm (b) 2 ohm

(c) 1 ohm (d) infinite

RRB Patna Technical Eng., 27.07.2008

Ans : (a) For a voltage source internal resistance is equal to output resistance i.e. 4 ohms according to maximum power transfer

$R_i = R_{th}$

Net internal resistance = Net external resistance

180. Dimension of Resistance-

(a) $[ML^2T^{-3}A^{-2}]$ (b) $[MLT^{-3}A^{-1}]$

(c) $[M^2LT^{-3}A^{-1}]$ (d) $[ML^2T^{-1}A^{-1}]$

RRB Patna/Allahabad ESM-III , 30.01.2011

Ans : (a) Dimension formula of the resistance is $[ML^2T^{-3}A^{-2}]$. By Ohm's law, ratio of V and I is constant, equal to resistance R.

Hence, $V = IR$, $R = \dfrac{V}{I}\Omega$

$$R = \frac{W}{qI} \qquad \left[\because V = \frac{W}{q}, q = It \right]$$

$$R = \frac{F.S}{I^2 t} \qquad [w = F.S, q = It]$$

Where, F = force, S = displacement

$$= \frac{[MLT^{-2}][L]}{[A^2T]} = [ML^2T^{-2}][A^{-2}T^{-1}]$$

$$= [ML^2T^{-3}A^{-2}]$$

181. Which has a higher resistance: a 2 KW electric heater or a 200 W filament bulb, both marked for 230V-

(a) 200 W Bulb (b) 2 KW heater

(c) can't say (d) both are equal

RRB Patna/Allahabad ESM-III , 30.01.2011

Ans : (a) Given,

$P_1 = 2 \times 10^3$ W (Heater)

$P_2 = 200$W (Bulb)

$V = 230$V

$$\text{Resistance (Heater)} = \frac{V^2}{P_1} = \frac{(230)^2}{2000}$$

$$= \frac{52900}{2000} = \frac{264.5}{10} = 26.45\Omega$$

$$\text{Resistance (Bulb)} = \frac{V^2}{P_1} = \frac{(230)^2}{200} = 264.5\Omega$$

Hence, the resistance of 200W bulb is more than 2KW heater.

182. The filament of 60W and 100W bulbs are of the same length then

(a) 60W filament is thicker

(b) 100W filament is thicker

(c) both are of same thickness

(d) can't be assessed

RRB Bangalore Section Eng. 01.02.2009

Ans : (b) Resistance of 100W bulb will lesser hence according to $R = \rho \dfrac{\ell}{A}$ the filament will thicker.

$$\downarrow R = \frac{V^2}{P \uparrow}$$

P = Power

V= Voltage

R= Resistance

$$\uparrow A = \rho \frac{\ell}{R \downarrow} \qquad (l \text{ constant})$$

Hence, it is clear that filament has thicker, then resistance will less and it power will more.

183. A 100 Ω resistor is connected to 220 V- 50 Hz AC supply. What is the net power consumed for a complete cycle-

(a) 242 W (b) 484 W

(c) 220 W (d) 100 W

RRB Bangalore Section Eng. 01.02.2009

Ans : (b) Given, V= 220V, R = 100Ω

Formula, $P = \frac{V^2}{R}$

$= \frac{(220)^2}{100} = \frac{48400}{100} = 484\text{Watt.}$

184. A 12 mA current source has an internal resistance, R_S of 1.2KΩ. The equivalent voltage source is–

(a) 1.44V (b) 14.4V
(c) 7.2V (d) 72 mV

(RRB Mumbai C&G JE 25.10.2009)

Ans : (b) Given,
I = 12mA or 12×10^{-3} A.
R = 1.2 KΩ or $1.2 \times 10^3\Omega$
V = IR
$V = 12 \times 10^{-3} \times 1.2 \times 10^3$
V = 14.4 V

185. A constant current source supplies a electric current of 200 mA to a load of 2kΩ. When the load changed to 100Ω, the load current will be

(a) 9 mA (b) 4A
(c) 4 mA (d) 400 mA

RRB Patna Technical Eng., 27.07.2008

Ans : (b) Given, I = 200mA, $R_{L_1} = 2k\Omega$

Voltage across load (V) = $I R_{L_1}$

$V = 200 \times 10^{-3} \times 2 \times 10^3$
V = 400 V

The current when the load is changed to 100Ω, then-

$I = \frac{V}{R_{L_2}}$

$I = \frac{400}{100}$

I = 4A

186. A 220V, 100W Bulb is connected to a 110 V source. Calculate the power consumed by the bulb?

(a) 20 W (b) 15 W
(c) 10 W (d) 25 W

RRB Patna Technical Eng., 27.07.2008

Ans : (d) Given,
V = 220 V
P = 100W

Resistance of bulb $R = \frac{V^2}{p}$

$R = \frac{220 \times 220}{100}$

R = 484Ω

If voltage is 110V, then power consumed by bulb

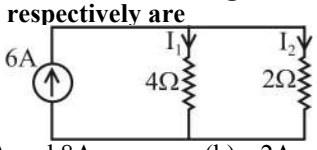
$P = \frac{V^2}{R}$

$P = \frac{110 \times 110}{484}$

$P = \frac{12100}{484}$

P = 25 watt

187. In the circuit shown in Figure The currents I_1 and I_2, respectively are



(a) 4A and 8A (b) 2A and 4A
(c) 4A and 2A (d) 6/5A and 12/5A

RRB Patna Technical Eng., 27.07.2008

Ans : (b) According to division current rule-

$I_1 = \frac{IR_2}{R_1 + R_2}$

$I_2 = \frac{IR_1}{R_1 + R_2}$

I = 6A, $R_1 = 4\Omega$, $R_2 = 2\Omega$

$I_1 = \frac{6 \times 2}{4 + 2} \Rightarrow I_1 = 2A$

$I_2 = \frac{6 \times 4}{4 + 2} \Rightarrow I_2 = 4A$

188. A circuit component that opposes the change in the current through it is

(a) resistance (b) inductance
(c) capacitance (d) none of these

RRB Kolkata Jr. Engineer-II 11.06.2006

Ans : (b) The inductor opposes the sudden change in the current through it.

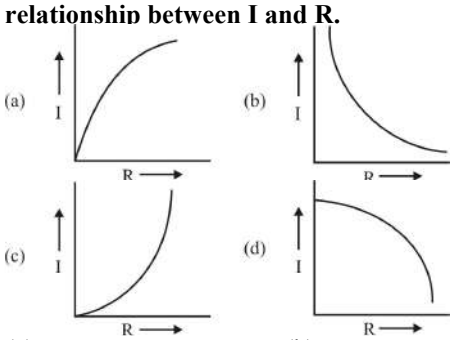
■ In inductor, also called a coil, choke or reactor.
■ It is a passive two-terminal electrical component.
■ It stores energy in a magnetic field when electric current flows through it.

$U = \frac{1}{2} LI^2 \text{ Joule}$

■ $L = \frac{V_L}{\frac{dI}{dt}} = \frac{N\phi}{I} = \frac{N^2}{S} = \frac{\mu_o \mu_r A N^2}{\ell}$

■ Unit of inductor is henary.

189. A moving resistance R is connected across a electric source V volt. If the value of resistance R is increased then which curve will show the relationship between I and R.



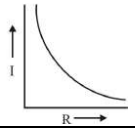
(a) B (b) D
(c) A (d) C

(LMRC SC/TO 2015)

Ans : (a) According to Ohm's law
V = IR

$\downarrow I = \frac{V}{R \uparrow}$

On increasing the value of resistance, there will decreases in the value of current. Hence, this is shown by curve (B).



190. In a conductor, current density is the :
(a) Current flowing per unit area
(b) Current flowing per unit volume
(c) Current flowing per unit mass
(d) Current flowing per unit length

(LMRC 2015)

Ans : (a) Current density is the current flowing per unit area. It is a vector quantity.

$$J = \frac{I}{A} \text{ Ampere/meter}^2$$

J = Current density
I = Current
A = Area

191. A charge of 360 C is transferred in 2 minutes. The current flowing is :
(a) 180A (b) 60 A (c) 2 A (d) 3 A

RRB Kolkata, 06.02.2005

Ans : (d) Charge (q) = 360C
Time (t) = 2 Minute = 2×60 seconds

$$\text{Current (i)} = \frac{\text{Charge}}{\text{Time}} = \frac{360}{2\times 60} = 3\text{A}$$

192. The ratio of resistances of a 100 W, 220 V lamp to that of a 100 W, 110 V lamp will be at respective voltages–
(a) 4 : 1 (b) 2 (c) 1/2 (d) 1/4

RRB Bangalore Material Engg, 21.11.2004

Ans : (a) Resistance for 100W, 220 V lamp

$$R_1 = \frac{V^2}{P} = \frac{220^2}{100} \quad .....(i)$$

Resistance for 100W, 110V lamp

$$R_2 = \frac{V^2}{P} = \frac{110^2}{100} \quad .....(ii)$$

Divide equation (i) with equation (ii)

$$\frac{R_1}{R_2} = \frac{220^2}{110^2} = \frac{4}{1}$$

$$\frac{R_1}{R_2} = \frac{4}{1}$$

193. If 750 μA is flowing through 11 kΩ of resistance, what is the voltage drop across the resistor?
(a) 82.5 V (b) 8.25 V
(c) 146 V (d) 14.6 V

(RRB Mumbai C&G JE 25.10.2009)

Ans : (b) Given,
$I = 750 \times 10^{-6}$A
$R = 11 \times 10^3$
V = ?
V = IR
$V = 750 \times 10^{-6} \times 11 \times 10^3 = .750 \times 11 = 8.250$

$\boxed{V = 8.25\,V}$

194. What is the current carrying capacity (amp) of 0.0001 ohms resistor with 500 watts power dissipation?
(a) 2236 (b) 1000 (c) 700 (d) 150

(RRB Malda SSE 25.10.2009)

Ans : (a) Resistance = 0.0001Ω
Wattage = 500 watt
current = ?
$P = I^2R$

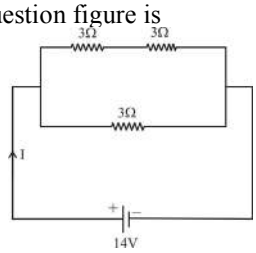
$$I^2 = \frac{P}{R} = \frac{500}{0.0001}$$

$I^2 = 5000000$
$I = \sqrt{5000000}$
I = 2236 Amp

195. In a circuit, two 3 ohm resistance are connected in series to a parallel combination of 3 ohm resistance. If the supply voltage is 14 V, the value of current in the circuit will be–
(a) 3 A (b) 7A
(c) 7/3 A (d) 42 A

(RRB Allahabad JE 25.10.2009)

Ans : (b) Number of resistance = 3
According to question figure is



$R_T = (3+3) \| 3$

$$\text{Total resistance } (R_T) = \frac{6\times 3}{9} = 2\Omega$$

$$\text{Current (I)} = \frac{\text{Voltage}}{\text{Resistance}} = \frac{14}{2} = 7 \text{ Amp}$$

196. A lamp of 100 W at 200 V is supplied current at 100 volts. It is equivalent to lamp of
(a) 20 W (b) 25 W
(c) 50 W (d) 75 W

RRB Bangalore. 21.11.2004

Ans : (b) Given,
P = 100watt
Rated voltage V = 200V
Supply voltage V = 100volt

$$\because P = \frac{V^2}{R}$$

$$R = \frac{200\times 200}{100} = 400\Omega$$

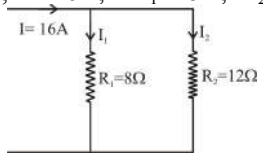
Now voltage reduced to 100V then consumed power.

$$P = \frac{V^2}{R} = \frac{100\times 100}{400} = 25\text{Watt}$$

197. A current of 16 amperes divides between two branches in parallel of resistance 8 Ohms and 12 Ohms respectively. The current in each branch is
(a) 6.4 A, 6.9 A (b) 6.4 A, 9.6 A
(c) 4.6 A, 6.9 A (d) 4.6 A, 9.6 A

(RRB Mumbai C&G JE 25.10.2009)

Ans : (b) Given, I = 16A, $R_1 = 8\Omega$, $R_2 = 12\Omega$



From current divider rule

(i) current in 8Ω

$$I_1 = 16\times\frac{12}{8+12} \quad \left(I_1 = I\times\frac{R_2}{R_1+R_2}\right)$$

$$= 16\times\frac{12}{20} = 9.6 \text{ A}$$

(ii) current in 12Ω

$$I = 16\times\frac{8}{12+8} \quad \left(I_2 = I\times\frac{R_1}{R_1+R_2}\right)$$

$$= 16\times\frac{8}{20} = 6.4 \text{ A}$$

198. What is the approximate value of resistance of filament of a 150 W at 350 V bulb?

(a) 810 Ω (b) 855 Ω
(c) 816 Ω (d) 796 Ω

RRB Kolkata Apprentice Engg., 14.10.2001

Ans : (c) Given, Bulb voltage = 350 V
Bulb power = 150 W, bulb resistance = ?

$$R = \frac{V^2}{P}$$

$$R = \frac{350\times350}{150} = \frac{7\times350}{3} = 816.66\ \Omega$$

$$R \simeq 816\ \Omega$$

199. The bulb in street lights are connected in .....

(a) In parallel (b) In series
(c) In series-parallel (d) In end to end

(RRB 2014)

Ans : (a) In street lights, the bulbs are connected in parallel so that the same voltage is obtained across each light.

■ Current in parallel connection different in each bulbs.

■ If bulbs are connected in series, then the voltage across each bulb will be different. When we are increase in the number of bulb then voltage and brightness will decreases.

200. Area of cross-section of a 100 m long wire is 0.1 mm^2 and resistivity is 50×10^{-8} Ω m. What will be its resistance?

(a) 500 Ω (b) 5000 Ω
(c) 250 Ω (d) 50 kΩ

(RRB 2014)

Ans : (a) Given, length (l) = 100 m
cross sectional area (A) = 0.1 $mm^2 = 1\times10^{-7}m^2$

$$R = \rho\frac{\ell}{A}$$

$$R = \frac{50\times10^{-8}\times100}{1\times10^{-7}} = 50\times10^{-8}\times10^{7}\times100$$

$$= 5\times100 = 500\ \Omega$$

$$R = 500\ \Omega$$

201. Consider an electric heating element desgined to dissipate 450 W at 250 V mains and made 1 mm wide and 0.05 mm thickness a nichrom ribbon. If the resistivity of nichrome is 1.10×10^{-8}Ω-m, then what is the length of ribbon required?

(a) 63.1 m (b) 6.31 m
(c) 6310 m (d) 631 m

(RRB 2014)

Ans : (d) Given, V = 250 volts
P = 450 W
Width (b) = 1 mm = 10^{-3}m
Thickness t = 0.05 mm = 5×10^{-5}m
Resistivity (ρ) = 1.10×10^{-8}Ω-m
Length of ribbon (l) = ?
Cross section area of ribbon = b×t
$A = 10^{-3} \times 5 \times 10^{-5}$
$A = 5 \times 10^{-8}\ m^2$

$$\because P = \frac{V^2}{R} \Rightarrow R = \frac{V^2}{P}$$

$$\Rightarrow R = \frac{250\times250}{450} = \frac{250\times5}{9} \Rightarrow R = \frac{1250}{9}\Omega$$

$$l = \frac{R.A}{\rho} \quad \left(\because R = \frac{\rho l}{A}\right)$$

$$\Rightarrow l = \frac{\frac{1250}{9}\times5\times10^{-8}}{1.10\times10^{-8}} = \frac{1250\times5\times10}{9\times11} = 631.31$$

$$l \simeq 631 \text{ m}$$

Hence, the length of ribbon required will be 631m.

202. A 40 W bulb is connected in series with a room heater. If now 40 W bulb is replaced by 100 W bulb, heater output will

(a) decrease
(b) remain same
(c) heater will burn out
(d) increase

(RRB Allahabad JE 25.10.2009)

Ans : (d) The output current in-room heater will increase, then according to I^2R output will be increase also of the heater.

From, $P = \frac{V^2}{R}$

$$R_1 = \frac{V^2}{P} = \frac{V^2}{40} = 0.025\,V^2$$

If 40W bulb are replaced by 100 W bulb then resistance of circuit will changed

$$R_2 = \frac{V^2}{P} = \frac{V^2}{100} = 0.01\,V^2$$

$R_1 > R_2$ so now if a 100 watt bulb is installed, then current will flow more than before due to this the output of the heater will increase.

203. Two wires A and B have the same cross section and are made of the same material. R_A = 800 Ω and R_B = 100Ω. The number of times A is longer than B is:

(a) 2 (b) 4
(c) 5 (d) 8

(RRB Allahabad JE 25.10.2009)

Ans : (d) Given, for wire A

$R_A = 800\Omega$, $\rho_A = \rho$

For wire B

$R_B = 100\Omega$, $\rho_B = \rho$

$$R = p\frac{l}{A}$$

$$R\alpha\frac{l}{A}$$

Cross section area is same for both wire-

$$\frac{R_A}{R_B} = \frac{l_A}{l_B} \Rightarrow \frac{800}{100} = \frac{l_A}{l_B}$$

$$8 = \frac{l_A}{l_B}$$

$$\boxed{l_A = 8l_B}$$

204. A 100 Ω resistor is to be used to carry a current of 0.5 A. Its power rating should be.....watt

(a) 50 (b) 25

(c) 200 (d) 500

RRB Kolkata Apprentice Engg., 14.10.2001

Ans : (b) Given, Resistance $(R) = 100\Omega$

Current $(I) = 0.5$ Amp

Voltage $(V) = IR = 100 \times 0.5 = 50$ volt

Power rating $(P) = i^2R = (0.5)^2 \times 100$

$= 0.25 \times 100 = 25$ watt

205. Six light bulbs are connected in parallel across 110V. Each bulb is rated at 75W. How much current flows through each bulb?

(a) 0.682 A (b) 0.7 A

(c) 75 A (d) 110 A

RRB Kolkata Engg. 20.02.2000

Ans : (a) Given,

Voltage $(V) = 110$V

Power $(P) = 75$W

$$\text{Current (I)} = \frac{P}{V} = \frac{75}{110} = 0.682 \text{ Amp.}$$

206. In a four-branch parallel circuit, there are 10 mA of current in each branch. If one of the branches is open, the current in each of the other three branches is :

(a) 13.3 mA (b) 10 mA

(c) 0A (d) 30mA

RRB Kolkata Engg. 20.02.2000

Ans : (b) The current in each of the other three branches will be flow 10 mA only because the current in parallel circuit are different while voltage is same in each branch. If one of the branch is opened, then it does not effect the other branches current because the voltage and resistance across remaining branches will remain same.

207. If current passing through a conductor in a transmission line is decreased by a factor of 3 (keeping other parameters constant), its effective resistance …… .

(a) increases 3 times (b) decreases 3 times

(c) increases 9 times (d) decreases 9 times

RRB Kolkata, 06.02.2005

Ans : (c) If the current flowing through a conductor in a transmission line is reduced by a factor of 3 (Keeping other parameters constant). Its effective resistance will increase by 9 times.

$$\boxed{R_{eff} = \frac{\text{Power loss in the conductor}}{I^2}}$$

where R_{eff} = effective resistance of conductor

$$R_{eff} \propto \frac{1}{\left(\frac{I}{3}\right)^2}$$

$$R_{eff} \propto \frac{9}{I^2}$$

$$\boxed{R_{eff} \propto 9 \text{ times}}$$

208. An ideal current source has zero

(a) Internal conductance (b) Internal resistance

(c) Voltage on no load (d) Ripple

RRB Kolkata, 06.02.2005

(RRB Allahabad JE 19.12.2010)

Ans : (a) Internal resistance of an ideal current source is infinite and internal conductance is zero.

Since, $G = \frac{1}{R} = \frac{1}{\infty} = 0$

Where, G = conductance

R = resistance.

209. Two incandescent light bulbs of 40 W and 60 W rating are connected in series across the mains. Then

(a) the bulbs together consume 100 W

(b) the bulbs together consume 50 W

(c) the 60 W bulbs glows brighter

(d) the 40 W bulbs glows brighter

RRB Kolkata, 06.02.2005

Ans : (d) In series connection, the current is flowing in all the bulb is equal, so when 40 W bulb and 60 W bulb are connected in series, the current is flow same in them. To find out which bulb will be more luminous. It is necessary to know the power dissipation.

Power $(P) = I^2 R$ watt

In series power dissipation in a bulb of higher resistance will be higher due to this the 40 W bulb (maximum resistance) will glows brighter because its resistance is more in comparison to 60 W bulb.

210. The equivalent resistance in ohms in the circuit shown is

(a) $\frac{1}{6}$ (b) 6

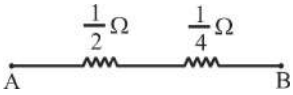
(c) $\frac{3}{4}$ (d) $\frac{4}{3}$

(JMRC JE 10.06.2017)

Ans : (c) Here the conductance is given in Siemens.

Hence $R_1 = \frac{1}{G_1}$ $R_2 = \frac{1}{G_2}$

$R_1 = \frac{1}{2}\Omega$, $R_2 = \frac{1}{4}\Omega$



R_1 and R_2 In series = $R_{eq} = \frac{1}{2} + \frac{1}{4} = \left(\frac{2+1}{4}\right) = \frac{3}{4}\Omega$

211. Two bulbs, one 250 V, 100 W and second 250 V, 25 W are connected in series and 440 V AC, 50 Hz is applied across the two bulbs. Which of the following will happen?

(a) 100 W bulb glows bright compare to 25 W bulb
(b) both 100 W bulb & 25 W bulb will glow normal
(c) 25 W bulb will burn-out
(d) 25 W bulb glows bright compare to 100 W bulb

(JMRC JE 10.06.2017)

Ans : (d) According to $R = \frac{V^2}{P}$

V and P is given for both bulb, I is same in series then,

Resistance of 25 watt bulb

$$R_{25} = \frac{(250)^2}{25} = 2500\,\Omega$$

Resistance of 100 watt bulb

$$R_{100} = \frac{(250)^2}{100} = 625\,\Omega$$

Here $R_{25}, > R_{100}$

We knows current in series is same for both bulb. So according to I^2R, the 25 watt bulb will glow brighter than 100 watt bulb because $R_{25} > R_{100}$ and I same for each.

212. With reference to V and I defined in the circuit, compute R if i = –3.4 mA and v = –8.9 V.

(a) 5.8 KΩ (b) 55.0 Ω
(c) 54.98 KΩ (d) 2.61 KΩ

(RRB Allahabad JE 19.12.2010)

Ans : (d) Given,

V = –8.9 V , I = –3.4mA

From, $R = \frac{V}{I}$

$$R = \frac{-8.9}{-3.4\times10^{-3}} = 2.61\times10^3\,\Omega = 2.61\,k\Omega$$

213. Elements having same mass number but different atomic number are called-

(a) Isotone (b) Isobar
(c) Isotope (d) halogens

(RRB 2014)

Ans : (b) Elements having same mass number but different atomic number are called is Isobars.

Isobars : Isobars are atoms of different chemical elements that have the same number of nucleons, isobar differ in atomic number (No. of protons) but have same mass number

Example : ^{40}S, ^{40}Cl, ^{40}Ar, ^{40}K and ^{40}Ca

These elements all contain 40 nucleons, they contains varying numbers of protons and neutrons.

214. If two or more components are connected in ..... they have the same potential difference (voltage) across their ends.

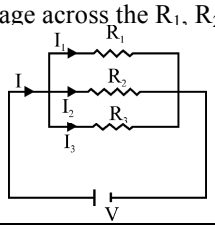
(a) Series (b) Parallel
(c) Opposite (d) Parallel-Series

(RRB Allahabad JE 19.12.2010)

Ans : (b) If two or more elements are connected in parallel, then the potential difference across their ends will be the same. In parallel connection, the voltage is same and current of the path is different parallel connection is made for low voltage and high current.

here $I = I_1 + I_2 + I_3$

V is the same voltage across the R_1, R_2 and R_3.

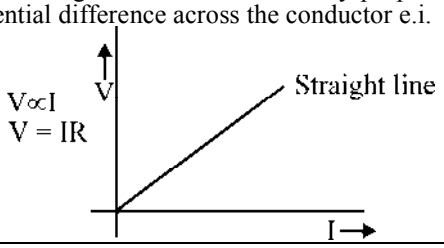


215. Which of the following V-I curve is a straight line according to ohm's law?

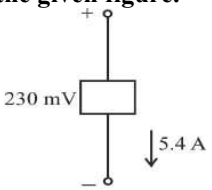
(a) conductors
(b) p type semiconductors
(c) thyristors
(d) alloys

(RRB Mumbai JE 05.10.2008)

Ans : (a) According to ohm's law, V-I curve of the conductor is a straight line by ohm's law, on keeping the physical state constant in any complete circuit, the current flowing in the circuit is directly proportional to the potential difference across the conductor e.i.



216. Find the power being absorbed by the circuit element in the given figure.



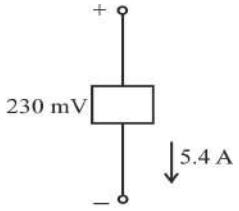
(a) 453.0 W (b) 1.242 W
(c) 3.564 W (d) 42.59 W

(RRB Mumbai JE 05.10.2008)

Ans : (b) Given,

V = 230 mV or 230×10^{-3} V, I = 5.4 A

$P = VI = 230 \times 10^{-3} \times 5.4 = 1.242$ W



217. Amount of electricity consumed by a 100 watt bulb (in the On state for 10 hours) is–

(a) 100 Watts per Hour
(b) 100 Watts
(c) 1 kWh = 1 Unit of electricity,
(d) 1000 Watts (1kW)

(RRB Mumbai C&G JE 25.10.2009)

Ans. (c) : Energy consuption in an electric circuit is the product of potential, current and time,
Its SI unit is kilowatt hour.
Electric Energy E = VI.t

$$E = \frac{V.I.t}{1000} kWh \qquad [\because P = VI = 100 \text{ watt}, t\ 10h]$$

$$E = \frac{100 \times 10}{1000}$$

$E = 1kWh = 1Unit$ [$\because$ 1 kwh = 1 unit]

218. Two bulbs are rated 100 W, each. If these bulbs are connected in series to the mains supply, 220V, the total power consumed by both the bulbs would be–

(a) 25 Watts (b) 50 Watts
(c) 100 Watts (d) 200 Watts

(RRB SSE Secunderabad Green paper, 21.12.2014)

Ans : (b) When two bulb are connected in series and voltage rating of them is same then to calculate the total power drawn from supply following formula is used.

$$P = \frac{P_1 \times P_2}{P_1 + P_2}$$

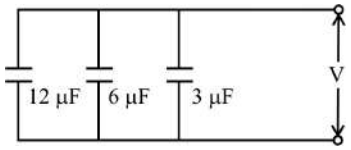
$$P = \frac{100 \times 100}{100 + 100} = 50 \text{ Watt}$$

219. Three capacitors of 3μF, 6μF and 12μF are connected in parallel across an AC source. The maximum current will pass through the _____.

(a) all the capacitors (b) 6 μF capacitor
(c) 12 μF capacitor (d) 3 μF capacitor

(RRB Mumbai SSE 05.10.2008)

Ans. (c) : All capacitor connected in parallel, across all capacitor the voltage will be equal, current is different.



$$(I_c) = \frac{V}{X_C}$$

Since $X_C = \frac{1}{2\pi fC}\ \Omega$

ie, $\downarrow X_C \propto \frac{1}{C\uparrow}$, then $X_{C(12)} < X_{C(6)} < X_{C(3)220.}$

hence $I_{12\mu F} > I_{6\mu F} > I_{3\mu F}$

The value of X_C depends upon capacitance (C). so which capacitance will be more, X_C will less for that and due to this maximum current will flow, in which X_C less.

Hence the maximum current will flow through the 12μF capacitor.

220. The force between two charges is 80 Newton. Keeping all other parameters constant, if the distance between the two charges is doubled then the new force between the two charge will be-

(a) 20 Newton (b) 320 Newton
(c) 40 Newton (d) 160 Newton

(RRB Mumbai SSE 05.10.2008)

Ans : (a) $F_1 = 80$ Newton
$d_1 = d$ meter

$$F_1 = \frac{q_1 q_2}{4\pi\varepsilon_0\varepsilon_r d_1^2} \quad \text{-------- (i)}$$

Now $d_2 = 2d$ meter and other parameter keeping constant (given)

then, $F_2 = \frac{q_1 q_2}{4\pi\varepsilon d_2^2}$ ------ (ii)

equation (i) divided by (ii)

$$\frac{F_1}{F_2} = \frac{\frac{q_1 q_2}{4\pi\varepsilon d_1^2}}{\frac{q_1 q_2}{4\pi\varepsilon d_2^2}}$$

$$\frac{F_1}{F_2} = \frac{q_1 q_2}{4\pi\varepsilon d_1^2} \times \frac{4\pi\varepsilon d_2^2}{q_1 q_2}$$

$$\frac{F_2}{F_1} = \frac{d_1^2}{d_2^2} = \frac{d^2}{(2d)^2} = \frac{d^2}{4d^2}$$

$$F_2 = \frac{F_1}{4} = \frac{80}{4} = 20 \text{ Newton}$$

$F_2 = 20$ Newton

hence the force applied will be one fourth as compared to before.

221. Determine the value of charge stored (in mC) in a capacitor, when the value of capacitance is 0.01 mF and the potential difference between the ends of the capacitor is 20 V.

(a) 0.2 (b) 2
(c) 20 (d) 200

(RRB Bhopal/Allabahad SSE 19.12.2010)

Ans : (a) Given,
potencial difference (V) = 20 volt
capacitance (C) = 0.01 mF = 0.01×10^{-3} Farad
From, Q = CV charged stores on plate.
Charge (Q) = $0.01 \times 10^{-3} \times 20$
$= 0.2 \times 10^{-3}$ coulomb

$$\boxed{Q = 0.2\,mC}$$

222. Which of the following is the correct expression for the capacitance?

(a) $C = \frac{Q}{V}$ (b) $C = Q - V$
(c) $C = QV$ (d) $C = \frac{V}{Q}$

(RRB Malda SSE 25.10.2009)

Ans : (a) The correct equation for capacitance is $C = \frac{Q}{V}$

■ Its SI unit is coulomb/volt or Farad.
■Capacitor stores energy in the form of charge in electric field.
■Stores energy in capacitor (U_c)

$$\boxed{U_c = \frac{1}{2}V^2C = \frac{1}{2}\frac{Q^2}{C} = \frac{1}{2}QV} \text{ Joules}$$

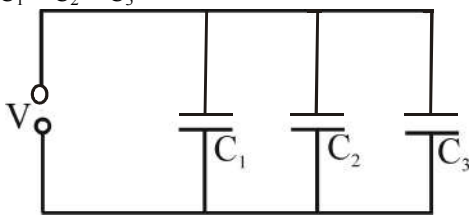
223. In parallel combination of capacitances, the equivalent capacitance is .....

(a) equal to the larges capacitance of the combination
(b) lower than the largest capacitance of the combination
(c) lower than the smallest capacitance of the combination
(d) greater than the largest capacitance of the combination

(Konkan Railway TA 2017)

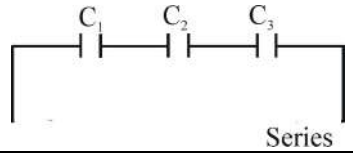
Ans : (d) In parallel combination of capacitors, the equivalent capacitance is greater than that of the largest capacitor in the combination. i.e. the total capacitance is simply the sum of all capacitances.

$C_{eq} = C_1 + C_2 + C_3$



■If capacitors are connected in series, then the values of equivalent capacitance is less than the capacitance of the smallest value of the combination.

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$



224. What will be the value of capacitance (in micro-Farad) of a capacitor when the potential difference between the terminals of the capacitor is 40 V and the charge stored in the capacitor is 8 mC?

(a) 150 (b) 180
(c) 200 (d) 240

(RRB Bhopal/Allahabad JE 19.12.2010)

Ans : (c) Given,
Voltage difference across capacitor (V) = 40 V
charge on capacitor
$Q = 8 \times 10^{-3}$ coulomb

$$\text{Capacitance } (C) = \frac{Q}{V} F$$

$$C = \frac{8\times10^{-3}}{40} = 0.2 \times 10^{-3} F$$

$C = 200 \times 10^{-6} F$

$$\boxed{C = 200\,\mu F}$$

225. Electric current in a metal wire is due to the flow of ----------

(a) Proton (b) Electrons
(c) Ion (d) None of these

(RRB 2014)

Ans : (b) Electric current in a metal wire is due to the flow of electrons.

■ Electrons are negatively charge particles.
■ Mass of an electron is 9.109×10^{-31} kg
■ Charge on an electron is 1.6×10^{-19}C.

Ion Facts

(i) Ions are atoms or groups of atoms, with a charge.
(ii) The charge is created by different number of protons and electrons.
(iii) In an atom only electron can move
(iv) Atoms gain or lose electrons become ions.

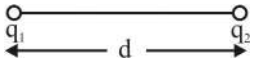
226. Charge q_1 applies a small force on q_2 charge. Now if the q_3 charge came near to them, then force applied on q_2 by q_1 is-

(a) Will increase of magnitude
(b) The magnitude of will decreases
(c) Will remains constant
(d) Increases when q_1 is of same sign of q_3 and decreases when q_1 is opposite charge of q

(RRB 2014)

Ans : (c) The force applied on q_2 by q_1 will remain constant. because

$$F = \frac{1}{4\pi\varepsilon_0\varepsilon_r} \cdot \frac{q_1 . q_2}{d^2}$$



∵ here q_1, q_2, d and ε is constant. So force applied by q_1 on q_2 is also constant but net force applied on q_2 will be changed due to on bringing the q_3 charge closer to them.
Note : On bringing charge q_3 closer to them, the magnitude of net force on q_2 will definitely change but the force applied by only q_1 will remain constant.

227. Light year is the unit of which of the following?

(a) Time (b) Distance
(c) Speed of light (d) Intensity of light

(RRB 2014)

Ans : (b) Light year is the unit of distance. The distance travelled by light in one year is called light year.
1 light year = 9.461×10^{15} meters
one parsec = 3.261 light year.
= 3.08×10^{16} meters
■ Parsec is a unit of distance.

228. When 2A current flows through a copper wire for 3 microseconds, then during that time (charge of electron 1.6×10^{-19}C). What will be the number of electrons flowing in the cross-section of the wire approximately.

(a) 3.75×10^{11} (b) 3.75×10^{12}
(c) 3.75×10^{13} (d) 3.75×10^{14}

(RRB 2014)

Ans : (c) Given, I = 2 A, $t = 3\ \mu$ sec $= 3\times10^{-6}$ sec
Charge of electron (e) = 1.6×10^{-19}C
No of electron = ?

$1\mu\text{sec} = 10^{-6}$ sec

∵ $q = It = 2 \times 3 \times 10^{-6} = 6 \times 10^{-6}$

$\because q = ne \Rightarrow n = \frac{q}{e} = \frac{6\times10^{-6}}{1.6\times10^{-19}}$

$\Rightarrow \frac{6}{1.6}\times10^{-6}\times10^{+19} = 3.75\times10^{13}$

$\Rightarrow n = 3.75 \times 10^{13}$

229. The temperature at which the volume of a gas is zero, what is it called?

(a) Absolute scale temperature
(b) Absolute zero temperature
(c) Absolute temperature
(d) None of these

(RRB 2014)

Ans : (b) The temperature at which the volume of a gas becomes zero is called absolute zero temperature. Its value is 0K or –273°C.

- Absolute zero is the lowest possible temperature and no lower temperature is possible at this temperature, the speed of the molecules of the substance becomes zero.
- **Charles's law :** Volume of the gas is directly proportional to temperature at constant pressure
  $V \propto T$
  $V = KT$

230. One meter is equal to which ?

(a) 10^{-6} micron (b) 10^{6} micron
(c) 10^{-3} micron (d) 10^{3} micron

(RRB 2014)

Ans : (b) One meter = 10^6 micron

- Some common metric prefixes used are as follows.

S.No.	Metra Prefix	Symbol	Power of 10
1.	peta	P	15
2.	tera	T	12
3.	giga	G	9
4.	mega	m	6
5.	kilo	k	3
6.	hecto	c	2
7.	deca	da	1
8.	deci	d	–1
9.	centi	c	–2
10.	milli	m	–3
11.	micro	μ	–6
12.	nano	n	–9
13.	angstron	A	–10
14.	pico	p	–12

231. What is the approximate velocity of sound in air?

(a) 3×10^6 m/s (b) 330 m/s
(c) 5000 m/s (d) 1500 m/s

(RRB 2014)

Ans : (b) The speed of sound is the distance travelled per unit of time by a sound as it propagates through an elastic medium. At 20°C, the speed of Sound in air is about 343 meters per second but in given option approximate option (b) is correct i.e. 330 m/s.

232. At what temperature is the density of water maximum?

(a) 0^0C (b) 100^0C
(c) 50^0C (d) 4^0C

(RRB 2014)

Ans : (d) The density of water at 4°C is maximum and at this volume is minimum.

- The volume of a certain quantity of water shrinks as the temperature drops below 4°C, and the speed of molecular motion slows.

233. Which of the following is not an ideal (Noble) gas ?

(a) Helium (b) Bromine
(c) Argon (d) Neon

(RRB 2014)

Ans : (b) He, Ne, Ar are the noble gases but Br is not noble gas it is a metal which is accupy in the form of liquid.

Noble gases : Noble gases are the chemical elements in the group 18 of the periodic table there are 6 Noble gases. They are He, Ne, Ar, Kr, Xe and Rn. They show no or very low reactivity among other chemical elements.

These elements have completely filled valence shells.

234. What is the term used to describe the ability of a device to store energy in the form of an electrical charge?

(a) inductance (b) conductance
(c) reactance (d) capacitance

RRB SSE (Shift –III) 02.09.2015

Ans : (d) The term capacitance is used to determine the ability of a device to store energy in the form of electric charge.

The amount of charge required to produce a unit potential difference between the plates is called capacitance i.e.

$\boxed{Q = CV}$ Coulomb

235. The reactance of capacitors increases as :

(a) applied voltage increases
(b) AC frequency increases
(c) applied voltage decreases
(d) AC frequency decreases

(RRB SSE (Shift-II), 03.09.2015), SAIL 29.3.2014

Ans (d) : The reactance of capacitors increases as the AC frequency decreases.

i.e. $X_C = \frac{1}{\omega C}$

$X_C = \frac{1}{\omega C}$

$\omega = 2\pi f$

Capacitor reactance $(X_C) = \frac{1}{2\pi fC}$

or $\uparrow X_C = \frac{1}{f \downarrow}$

02. Circuit Law

Circuit Law : Kirchhoff's law, Simple circuit solution using network theorems.

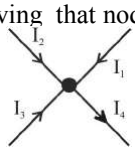
1. Kirchhoff's first law states that at a junction in an electric circuit-

(a) $\sum E = 0$ (b) $\sum I = 0$

(c) $\sum V = 0$ (d) $\sum E + \sum V = 0$

RRB JE (CRIS) Electrical 19.02.2023, 12:30-2:30 PM
DFCCIL Executive Electrical 30.09.2021
RRB JE 19.09.2019 Shift-II
RRB JE 01.09.2019 Shift-I

Ans. (b) : Kirchhoff's first law is based on the principle of conservation of electric charge. The algebraic sum of all current entering at a node is equal to the algebraic sum of all current leaving that node.



$I_1 + I_2 + I_3 = I_4$

$\boxed{I_1 + I_2 + I_3 - I_4 = 0}$

2. If there are "n" nodes in the circuit there will be _____ independent nodal equations.

(a) n+1 (b) n-2

(c) n (d) n-1

RRB JE (CRIS) Electrical 19.02.2023, 12:30-2:30 PM
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RRB JE 01.09.2019 Shift-I

Ans. (d) : If there are 'n' nodes in the circuit there will be n-1 independent nodal equations.

■ It is based on KCL and ohm's law.

3. Which of the following theorem is dual of Thevenin's theorem?

(a) Norton's theorem
(b) Reciprocity theorem
(c) Millman's theorem
(d) Superposition theorem

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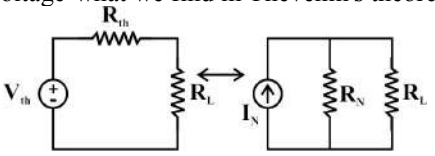
Ans. (a) : Norton's theorem is also known as the dual of Thevenin's theorem because in Norton's theorem we find short circuit current which is the dual of open circuit voltage-what we find in Thevenin's theorem.



- Thevenin's and Norton's equivalent circuits are related by source Transformations as:

$\boxed{I_N \quad \frac{V_{th}}{R_{th}}}$

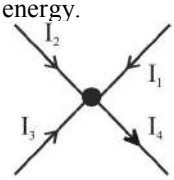
4. Kirchhoff's Current Law (KCL) is the first law that deals with the conservation of-

(a) Momentum (b) Charge

(c) Mass (d) Linear momentum

RRB JE 19.09.2019 Shift-II

Ans. (b) : Kirchhoff's current law (KCL) is the first law that deals with the conservation of charge while Kirchhoff's second law is voltage law (KVL) deals with the conservation of energy.



$\boxed{I_1 + I_2 + I_3 - I_4 = 0}$

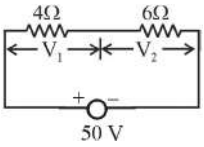
5. Two resistors of 4Ω and 6Ω are connected in series and supplied by 50V dc. What is the voltage across 6Ω resistor?

(a) 50V (b) 20V

(c) 10V (d) 30V

DMRC JE, 26.02.2020

Ans. (d) : Given, $R_1 = 4\Omega$, $R_2 = 6\Omega$, $V_s = 50V$



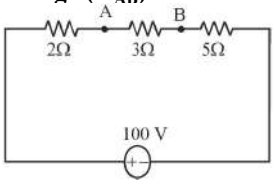
By voltage divider rule,

Voltage across 6Ω resistor

$$\boxed{V_2 = V_s \times \frac{R_2}{R_1 + R_2}}$$

$$= 50 \times \frac{6}{4+6} = 5 \times 6 = 30V$$

6. In the circuit shown below, if the resistor 3Ω across the terminals (AB) is disconnected, then find the voltage (V_{AB})?



(a) 100V (b) Zero

(c) 50V (d) 150V

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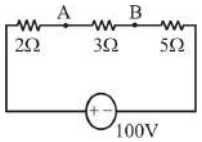
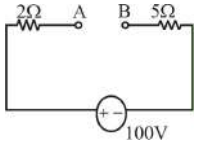
Ans. (a) : When, 3Ω resistor is disconnected from circuit, then circuit act as an open circuit at terminal A and B. Then voltage across the terminal A and B is equal to supply voltage.

So,

$\boxed{V_{AB} = 100V}$





7. A circuit consist of four resistors (5Ω, 10Ω, 20Ω, 30Ω) connected in parallel and supplied by a dc source of 100V. Which resistor among the four in the above circuit has least value of current?

(a) 30Ω (b) 5Ω (c) 10Ω (d) 20Ω

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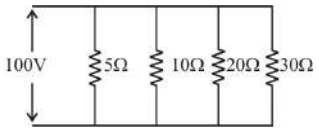
Ans. (a) : Given



$V = IR$

$$I \propto \frac{1}{R}$$

So, If the value of resistance is more than the current will be less. Hence, in 30 Ω resistance minimum value of current flows.

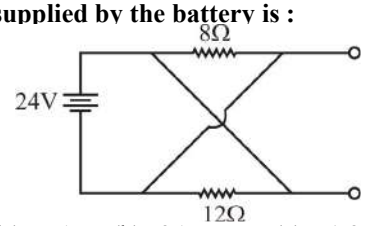
8. The average of all the instantaneous values of a sinusoidal quantity over a cycle is:

(a) 0.707 times of its maximum value
(b) Unity
(c) Maximum
(d) Zero

DMRC JE 18.02.2017

Ans : (d) The average of all the instantaneous values of a sinusoidal quantity over a cycle is zero. Sinusoidal wave is symmetrical wave. Its positive cycle and negative cycle is equal. Therefore the average value is only obtained by adding or integrating the average value of instantaneous values of half cycle.

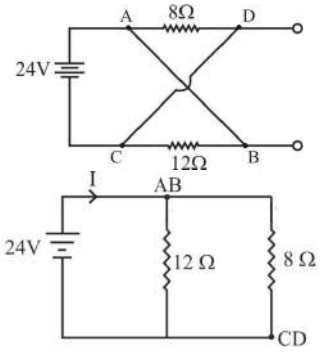
9. For the given circuit shown, the current supplied by the battery is :



(a) 5A (b) 3A (c) 1.2A (d) 2A

DMRC JE 18.02.2017

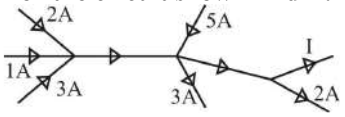
Ans : (a)



Equivalent resistance $(R_{eq}) = \frac{12\times 8}{12+8} = 4.8\Omega$

Current supplied by battery $(I) = \frac{V}{R_{eq}} = \frac{24}{4.8} = 5\,\text{Amp}$

10. For the circuit shown find I :



(a) 3A (b) 0A
(c) 6A (d) 1A

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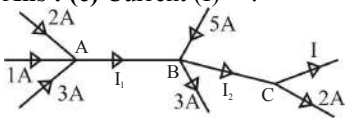
Ans : (c) Current (I) = ?



Apply KCL on Node A

Incoming current = outgoing current

$2+1+3 = I_1$

$I_1 = 6$ A

Apply KCL on Node B

$6+5 = I_2+3$

$I_2 = 11-3$

$= 8$ A

Apply KCL on Node C

$8 = I+2$

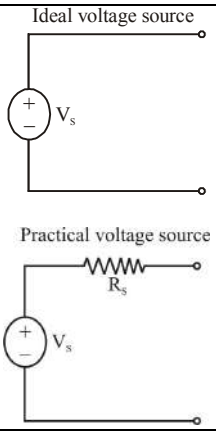
$I = 6A$

11. Ideal voltage source should have-

(a) Zero internal resistance
(b) Infinite internal resistance
(c) Large value of e.m.f.
(d) Medium internal resistance

DMRC JE 2018, Shift-III
RRB 2015

Ans. (a) : The internal resistance of an ideal voltage source is zero. It is able to supply any amount of energy irrespective of amount of current.



12. Which of the options is INCORRECT for the following statement?

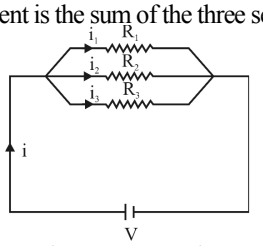
Three resistances are said to be parallel when:

(a) all the resistances are connected end-to-end
(b) current in each resistor is different and may be calculated by Ohm's Law
(c) potential difference across all resistances is the same
(d) the total current is the sum of the three separate currents

DMRC JE 10.04.2018, Shift-II

Ans : (a) Three resistances are said to be parallel when

- Current in each resistor is different and should be calculated by Ohm's law.
- Potential difference across all resistances is the same.
- The total current is the sum of the three separate currents.



$\boxed{i = i_1 + i_2 + i_3}$

Hence option (a) is incorrect.

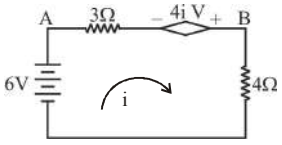
13. The circuit whose properties or characteristics change with the direction of its operation is:

(a) Non-linear (b) Unilateral
(c) Linear (d) Bilateral

DMRC JE 10.04.2018, Shift-II

Ans : (b) The element in which the voltage and current relationship is not same for current flowing in either direction (means changing input and output terminal impact on the operation) is known as unilateral element **Example-**Vacuum tube, diode etc.

14. For the given circuit, current through 3 Ω resistance is:



(a) 1.7 A (from B to A) (b) 3.5 A (from B to A)
(c) 3 A (from A to B) (d) 2 A (from A to B)

DMRC JE 10.04.2018, Shift-II

Ans : (d) Applying KVL in given circuit -

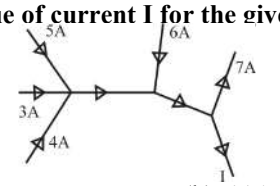
$-6 + 3i - 4i + 4i = 0$

$3i = 6$

$\boxed{i = 2}$ A

The movement of current is assumed as positive to negative direction hence the current flows from (A to B).

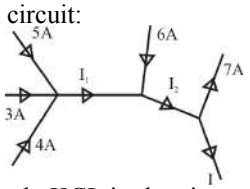
15. The value of current I for the given circuit is:



(a) 6A (b) 11A
(c) 7A (d) 3A

DMRC JE 2018, Shift-I

Ans. (b) : Given circuit:



From figure- Apply KCL in the given circuit-

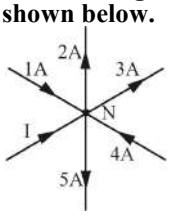
$I_1 = 5 + 3 + 4 = 12A$

$I_2 = I_1 + 6 = 12 + 6 = 18A$

$I = I_2 - 7 = 18 - 7$

$I = 11A$

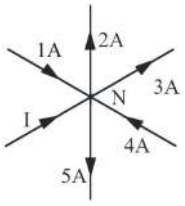
16. Find the current I flowing towards the node (N) in the circuit shown below.



(a) 15A (b) 1A (c) 5A (d) 10A

DMRC JE, 26.02.2020

Ans. (c) :



Applying KCL at node N -

Incoming current = Outgoing current

$1 + I + 4 = 2 + 3 + 5$

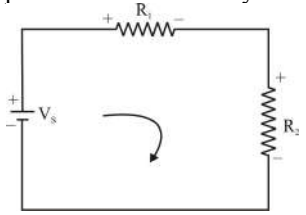
$\boxed{I = 5}$ A

17. According to Kirchhoff's law, the algebraic sum of all IR drops and emf's in any closed loop of a network is always:

(a) Negative (b) Positive
(c) Zero (d) One

DMRC JE 2018, Shift III

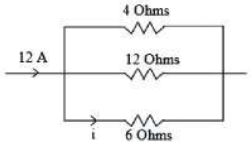
Ans. (c) : Kirchhoff's law- According to Kirchhoff's voltage law algebraic sum of all IR drop and emf's in any closed loop of a network is always zero.



$\sum IR + \sum emf = 0$

- It is independent on nature of the elements.
- It is work on the principle of law of conservation of energy.

18.



Find the current flowing through the 6 Ω resistor in the above figure.

(a) 6 A (b) 2 A
(c) 4 A (d) 5 A

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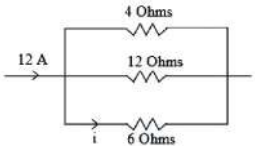
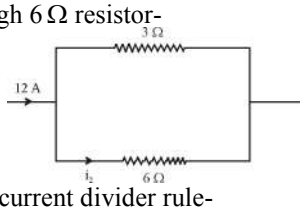
Ans. (c) : $I_6 = ?$



4Ω and 12Ω are in parallel

$$R_{eq} = \frac{4\times12}{4+12} = \frac{48}{16} = 3\Omega$$

Current through 6 Ω resistor-

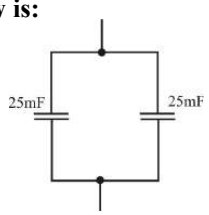


According to current divider rule-

$$I_2 = \frac{3\times12}{3+6} = \frac{3\times12}{9} = 4A$$

$$\boxed{I_2 = 4A}$$

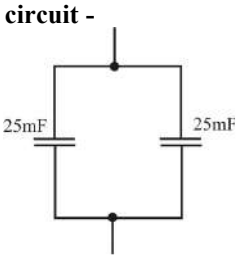
19. The equivalent capacitance of the combination given below is:



(a) 12.5 mF (b) 50 mF
(c) 2.5 mF (d) 25 mF

DMRC JE 2018, Shift-I

Ans. (b) : Given circuit -



For parallel connection equivalent capacitance-

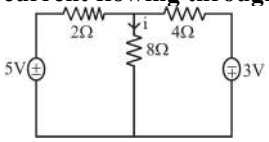
$C_{eq} = C_1 + C_2 + ...+C_n$

$C_{eq} = C_1 + C_2$

$= 25 + 25$

$C_{eq} = 50$ mF

20. In the circuit shown in the figure, find the current flowing through the 8Ω resistor?



(a) 0.25 A (b) 0.50 A
(c) 0.75 A (d) 0.10 A

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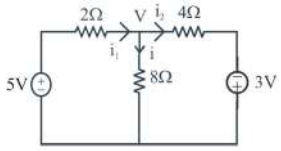
Ans. (a) : Given that,



Apply KCL at Node V-

$$-i_1 + i_2 + i = 0$$

$$\frac{V-5}{2} + \frac{V+3}{4} + \frac{V}{8} = 0$$

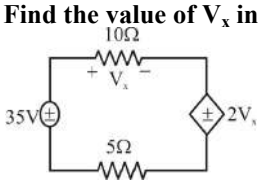
$$\frac{4V-20+2V+6+V}{8} = 0$$

$$7V-14=0$$

$$V = \frac{14}{7} = 2V$$

$$i = \frac{2}{8} = 0.25A$$

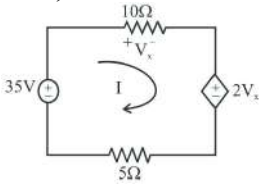
21. Find the value of V_x in the given circuit?



(a) 15 V (b) 10 V
(c) 5 V (d) -5 V

DMRC JE 20.02.2020

Ans. (b) : Given that,



Apply KVL-

$-35+10I+2V_x+5I=0$ [$V_x=10I$]

$-35+10I+20I+5I=0$

$35I= 35$

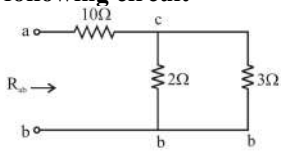
$I= 1A$

Hence,

$V_x = 10\times1$

$= 10$ V

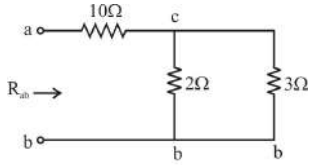
22. Find the value of resistance (R_{ab}) in the following circuit -



(a) 15Ω (b) 5.6Ω
(c) 21Ω (d) 11.2Ω

DMRC JE 20.02.2020

Ans. (d) :



$$R_{ab} = 10 + \frac{2\times3}{2+3} = 10 + \frac{6}{5} = \frac{56}{5} = 11.2\Omega$$

23. The current supplied by the battery shown below is: