Railway Recruitment Board

RRB JE

ELECTRONICS

&

Allied Engineering

Chapterwise Solved Papers

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INDEX

SYLLABUS
RRB JE CBT-2 Electronics Engineering

- **Electronic Components & Materials:** Conductors, Semiconductor& Insulators; magnetic materials; jointing & cleaning materials for U/G copper cable & OFC; Cells and Batteries (Chargeable and non chargeable); Relays, Switches, MCB & Connectors.
- **Electronic Devices and circuits:** PN Junction diodes, thyristor; Diode and triode circuits; Junction Transistors: Amplifiers; Oscillator; multivibrator, counters; Rectifiers; Inverter and UPS.
- **Digital Electronics:** Number system and Binary codes; Boolean Algebra & Logic gates; Combinational & Sequential logic circuits; A/D & D/A Converter, counters, Memories.
- **Linear Integrated Circuit:** Introduction to operational Amplifier, Linear applications; Non-Linear applications, Voltage regulators, Timers; Phase lock loop.
- **Microprocessor and Microcontroller:** Introduction to microprocessor, 8085 microprocessor working; Assembly Language programming; Peripherals & other microprocessors; Microcontroller.
- **Electronic Measurements:** Measuring systems; Basic principles of measurement, Range Extension methods, Cathode ray oscilloscope, LCD, LED panel, Transducers.
- **Communication Engineering:** Introduction to communication; Modulation techniques; Multiplexing Techniques Wave propagation, Transmission line characteristic, OFC; Fundamentals of Public Address systems, Electronic exchange, Radar, Cellular and Satellite communication.
- **Data communication and Network:** Introduction to data communication, Hardware and interface; Introduction to Networks and Networking devices; Local Area Network and Wide area Network; Internet working.
- **Computer Programming:** Programming concepts; Fundamentals of 'C' and C^{++}; Operators in 'C' and C^{++}; Control Statements; Functions, Array String & Pointers, File Structure; Data Structure and DBMS.
- **Basic Electrical Engg:** DC Circuits; AC fundamentals; Magnetic, Thermal and Chemical effects of Electric current; Earthing-Installation, Maintenance, Testing.

NE-01 (UPMRCL) SCTO
Electrical/Electronics & Telecommunication

BASIC ELECTRICAL ENGINEERING
Basic concepts and principles of D.C and A.C fundamental, A C 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, varactor diodes, LCD; 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 systems, control system examples from chemical systems, mechanical systems, electrical systems, introduction to Laplace transform. Transfer function analysis of ac and dc servomotors synchros, stepper motor, amply dyne. 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 Time Response Analysis : Standard test signals, time response of first and second-order system, time constant, time response of second order system, time response specifications, steady-state errors and error constants, problems in first and second order system. Stability: Routh Hurwitz Criterion, Root Locus, Bode Plotting using semi log graph paper Introduction to multiloop control system and its types, feed forward, cascade, ratio, split range, control system. Study of different processes using above mentioned control systems Non-Linear Control System : Introduction, behaviour of non-linear control system. Different types of nonlinearities, saturation, backlash, hysteresis, dead zone, relay, fiction, 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.

■ BASIC OF Microprocessors

Architecture of a typical microprocessor, configurations and instructional pair configuration systems and working of various peripheral interface chips. 8085 Microprocessors, architecture, instruction sets and introduction to 8086.

■ POWER ELECTRONICS

Introduction to thyristors and other power Electronics devices, Controlled Converters, Inverters, Choppers.

■ COMPUTER AIDED INSTRUMENTATION

Computer aided Instrumentation, Buses and Standards : Introduction , BUS types : The I/O BUS a) ISA bus b) EISA Bus c) PCI bus , GPIB 2.5 RS-232, Linear Circuits and Signal Conditioning, Parallel Port (PP) Interfacing Techniques, Serial Port (SP) Interfacing Techniques, USB Port Interfacing Techniques.

■ QUALITY AND RELIABILITY TECHNIQUES

Quality organization and Management: Introduction, Quality Policy, Task for Quality and Introduction to Total Quality Systems

Quality costs : Prevention costs, appraisal costs, internal failure costs, external failure costs, impact of quality costs on profitability

■ Basic Electrical Engg. And Electt. 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, Staring 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 thereon, 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-rating of circuit breakers: Principles of a arc extinction by oil and air, H.R.C. fuses, Protection earthier leakage, Over current Buchhotgz relay Merz-Prince system of protection of generators & transformers, Protection of feeders and bus bars., Lightning 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 drivers and motors.

Electronics Engineering
Previous Years Papers Analysis Chart

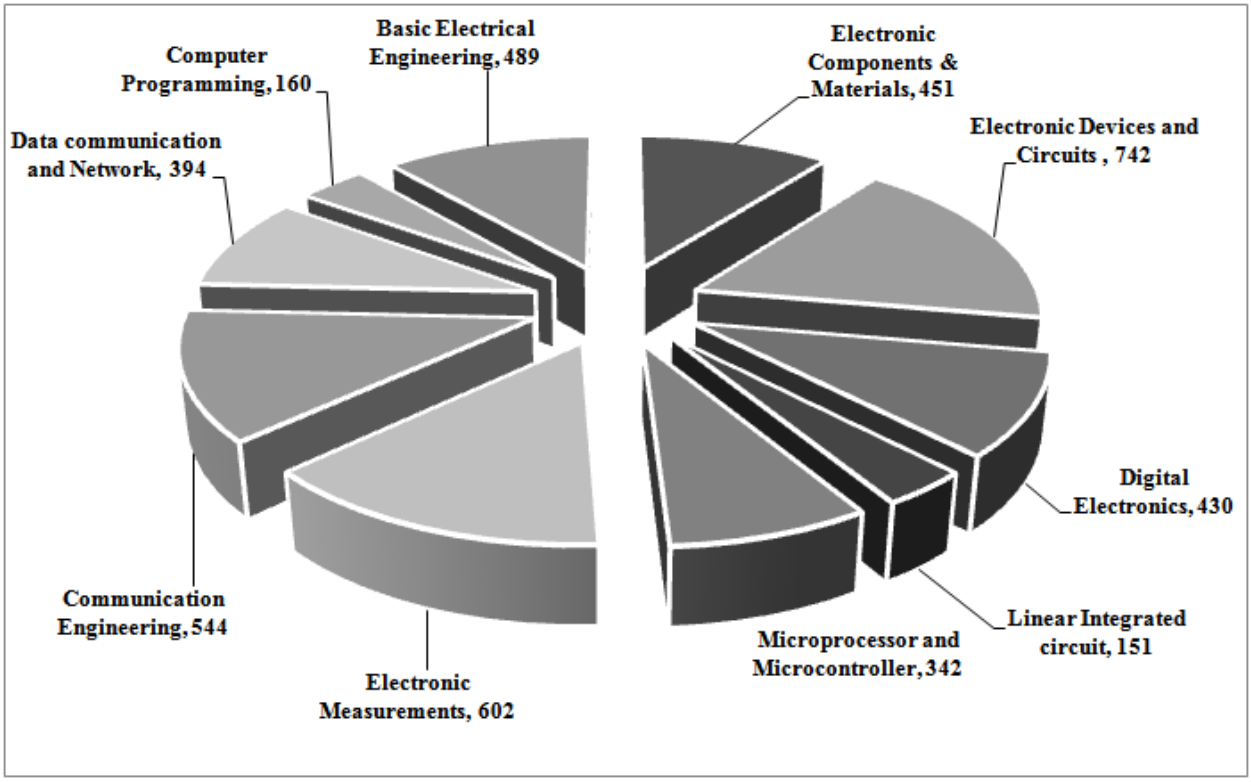
S.N.	EXAM NAME	EXAM DATE	No. of Questions
RAILWAY RECRUITMENT BOARD (RRB)-2025			
1.	RRB JE	22.04.2025 (Shift-I)	**100**
2.	RRB JE	22.04.2025 (Shift-II) Cancelled	**100**
3.	RRB JE	04.06.2025 (Re. Exam)	**100**
RAILWAY RECRUITMENT BOARD (RRB)-2019			
4.	RRB JE 2019	31.08.2019	**150**
5.	RRB JE 2019	01.09.2019	**150**
DEDICATED FREIGHT CORRIDOR CORPORATION OF INDIA LIMITED (DFCCIL)			
6.	DFCCIL S&T	17.12.2023	**60**
7.	DFCCIL Executive	20.12.2023	**96**
8.	DFCCIL S&T	29.09.2021	**96**
9.	DFCCIL Electrical	30.09.2021	**96**
10.	DFCCIL Electrical	11.11.2018	**96**
11.	DFCCIL Electrical	17.04.2016	**80**
12.	DFCCIL S&T	17.04.2016	**80**
UTTAR PRADESH METRO RAIL CORPORATION (UPMRC)			
13.	UPMRC JE (S&T)	03.01.2023	**90**
14.	LMRC SCTO Shift-II	17.04.2021	**90**
15.	LMRC JE (S&T) Shift-III	20.01.2020	**90**
16.	LMRC JE S&T	12.05.2018	**90**
17.	LMRC SCTO	16.04.2018	**90**
18.	LMRC JE	17.03.2016	**90**
19.	LMRC SCTO Shift-I	17.03.2016	**90**
20.	LMRC JE	26.06.2015	**90**
DELHI METRO RAIL CORPORATION(DMRC)/NMRC/JMRC			
21.	DMRC JE Electronics (Contract)	23-02-2020	**75**
22.	DMRC JE Electronics (Regular)	2020	**75**
23.	DMRC JE Electronics Shift-II	19.4.2018	**75**
24.	DMRC JE Electronics Shift-II	11.4.2018	**75**
25.	DMRC JE Electronics Shift-III	11.04.2018	**75**
26.	DMRC JE Electronics Shift-I	17.2.2017	**75**
27.	DMRC JE Electronics Shift-II	17.02.2017	**75**

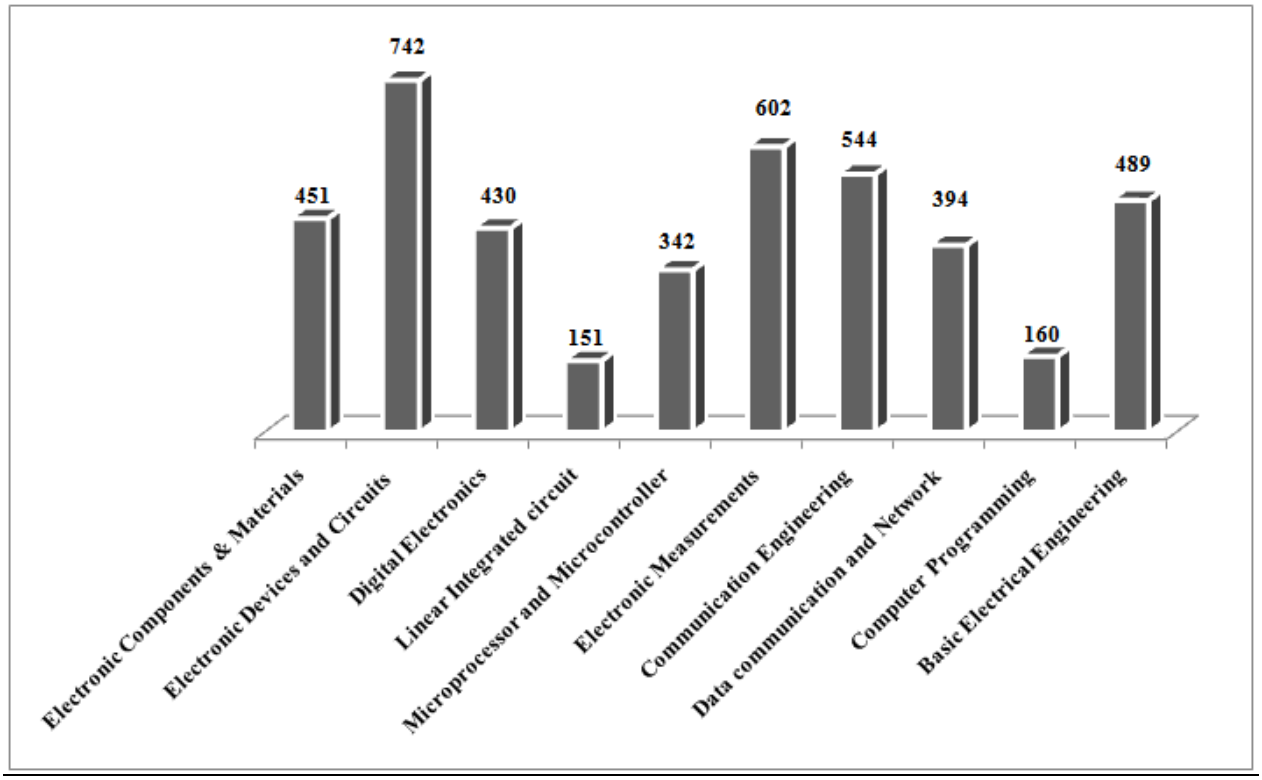
28.	DMRC JE Electronics Paper-I	06.03.2016	**75**
29.	DMRC JE Electronics Paper-I	15.03.2015	**75**
30.	DMRC JE Electronics Paper-I	21.09.2014	**75**
31.	NMRC BECIL	2019	**45**
32.	NMRC JE Electronics	2017	**75**
33.	NMRC JE Electrical	2017	**75**
34.	JMRC	2021	**48**
RAILWAY RECRUITMENT BOARD (RRB)-2015			
35.	RRB SSE Shift –I	01.09.2015	**20**
36.	RRB SSE Shift –II	01.09.2015	**21**
37.	RRB SSE Shift –III	01.09.2015	**21**
38.	RRB SSE Shift –I	02.09.2015	**22**
39.	RRB SSE Shift –II	02.09.2015	**20**
40.	RRB SSE Shift –III	02.09.2015	**21**
41.	RRB SSE Shift –I	03.09.2015	**22**
42.	RRB SSE Shift –II	03.09.2015	**20**
43.	RRB SSE Shift –III	03.09.2015	**20**
44.	RRB J.E Shift –II	04.09.2015	**21**
45.	RRB J.E Shift –III	16.09.2015	**22**
46.	RRB J.E Shift –I	26.08.2015	**22**
47.	RRB J.E Shift –II	26.08.2015	**21**
48.	RRB J.E Shift –III	26.08.2015	**20**
49.	RRB J.E Shift –I	27.08.2015	**22**
50.	RRB J.E Shift –II	27.08.2015	**21**
51.	RRB J.E Shift –III	27.08.2015	**20**
52.	RRB J.E Shift –I	28.08.2015	**22**
53.	RRB J.E Shift –II	28.08.2015	**19**
54.	RRB J.E Shift –III	28.08.2015	**21**
55.	RRB J.E Shift –I	29.08.2015	**20**
56.	RRB J.E Shift –II	29.08.2015	**22**
57.	RRB J.E Shift –III	29.08.2015	**22**
58.	RRB J.E Shift –III	30.08.2015	**21**
RAILWAY RECRUITMENT BOARD (RRB)-2014			
59.	RRB JE Allahabad	2014	**22**
60.	RRB JE Gorakhpur	2014	**23**
61.	RRB JE Chandigarh	2014	**22**
62.	RRB JE Jharkhand	2014	**21**
63.	RRB JE Guwahati	2014	**22**
64.	RRB JE Bhopal	2014	**23**
65.	RRB JE Ahmedabad	2014	**20**
66.	RRB JE Ajmer	2014	**21**
67.	RRB SSE Green Paper (Bilaspur, Secunderabad)	21.12.2014	**21**

68.	RRB SSE Yellow Paper (Bilaspur, Secunderabad)	21.12.2014	**22**
69.	RRB SSE Red Paper (Bilaspur, Secunderabad	21.12. 2014	**23**
OTHER RAILWAY JE & SSE Exams.			
70.	RRB Allahabad JE 2010	19.12.2010	**25**
71.	RRB Allahabad SSE 2010	19.12.2010	**23**
72.	RRB Mumbai JE 2008	05.10.2008	**28**
73.	RRB Mumbai SSE 2008	05.10.2008	**31**
74.	RRB Mumbai JE 2010	19.12.2010	**22**
75.	RRB Mumbai SSE 2010	19.12.2010	**26**
76.	RRB Bhubaneswar JE-II 2010	19.12.2010	**20**
77.	Konkan Railway STA 2017	2017	**24**
78.	Konkan Railway TA 2017	2017	**18**
79.	Konkan Railway SSE 2015	2015	**31**
80.	RRB Kolkata Diesel JE 2009	25.10.2009	**23**
81.	RRB Chandigarh SSE 2009	25.10.2009	**26**
82.	RRB Mumbai C&G JE 2009	25.10.2009	**24**
83.	RRB Gorakhpur RDSO SSE 2009	25.10.2009	**25**
84.	RRB Jammu JE 2009	25.10.2009	**23**
85.	RRB Malda SSE 2009	25.10.2009	**27**
86.	RRB Allahabad JE 2009	25.10.2009	**21**
87.	RRB Mumbai C&G SSE 2009	25.10.2009	**26**
88.	RRB Patna JE	25.10.2009	**23**
89.	RRB Bhopal TM SSE 2009	25.10.2009	**24**
90.	RRB Allahabad SSE 2012	09.09.2012	**25**
91.	RRB Bangalore SSE 2012	09.09.2012	**29**
92.	RRB Kolkata SSE 2012	09.09.2012	**18**
93.	RRB Gorakhpur Design SSE 2012	09.09.2012	**23**
94.	RRB Bhopal SSE 2012	09.09.2012	**25**
95.	RRB Chandigarh SSE 2012	09.09.2012	**28**
96.	RRB Jammu SSE 2012	09.09.2012	**23**
97.	RRB Allahabad JE 2012	09.09.2012	**21**
98.	RRB Bhubaneswar JE II 2008	29.11.2008	**25**
99.	Konkan Railway STA 2017	2017	**23**
100.	Konkan Railway TA 2017	2017	**24**
101.	Konkan Railway SSE 2015	2015	**20**

102.	RRB Kolkata Diesel JE 2009	25.10.2009	**22**
103.	RRB Bhopal Section Engineer,	24.11.2002	**24**
104.	RRB Bhopal & Mumbai Apprentice Section Engg.	23.03.2003	**28**
105.	RRB Secunderabad Section Engineer (Elect.)	29.06.2008	**22**
106.	RRB Bangalore Section Engineer (Elect.)	01.02.2009	**23**
107.	RRB Chandigarh Section Engineer,	15.03.2009	**25**
108.	RRB Chennai Section Engineer,	12.02.2012	**27**
109.	RRB Chandigarh Section Engineer (Elect.)	26.02.2012	**24**
110.	RRB Chandigarh Section Engineer,	26.02.2012	**29**
111.	RRB Jammu Section Engg., 2013	2013	**20**
112.	RRB Bhubaneswar Section Engineer (Electrical)	19.08.2001	**18**
113.	RRB Kolkata Engineer	20.02.2000	**15**
114.	RRB Kolkata Apprentice Engineer	14.10.2001	**20**
115.	RRB Bangalore Material Engineer	21.11.2004	**21**
116.	RRB Kolkata Mech. Engineer	06.02.2005	**15**
117.	RRB Allahabad Junior Engineer-II	08.01.2006	**15**
118.	RRB Kolkata Jr. Engineer-II Electrical DRG & Design,	11.06.2006	**15**
119.	RRB Kolkata Technical- Engineer	20.08.2006	**28**
120. .	RRB Chennai Technical (Engineer)	15.04.2007	**25**
121.	RRB Bangalore Technical (Engineer)	22.04.2007	**27**
122.	RRB Secunderabad Technical (Engg.)	20.05.2007	**22**
123.	RRB Patna Technical Engineer,	27.07.2008	**28**
124.	RRB Thiruvananthapuram Section Eng.	04.01.2009	**19**
125.	RRB Bangalore Section Engineer	01.02.2009	**23**
126.	RRB Chandigarh Section Engineer	15.03.2009	**26**
127.	RRB Chandigarh Section Engineer	26.02.2012	**27**
128.	RRB Bhopal Section Engineer	24.11.2002	**20**
Total			**5042**

Trend Analysis of Electronics Questions Through Pie Chart and Bar Graph





01. Electronic Components and Materials

■ Conductors ■ Semiconductor & Insulators ■ Magnetic materials ■ Jointing & cleaning materials for U/G copper cable & OFC ■ Cells and Batteries (Chargeable and non chargeable) ■ Relays ■ Switches ■ MCB & Connectors.

(i) Conductors

1. Tungsten, due to its high melting point and excellent electrical conductivity, is widely used in high-temperature applications. Which of the following properties of tungsten makes it particularly suitable for use in electrical components like filaments and electrodes in high-temperature environments?

(a) High electrical conductivity and low resistivity
(b) High melting point and resistance to thermal shock
(c) High melting point and low coefficient of expansion
(d) Low melting point and excellent oxidation resistance

RRB JE 04.06.2025, Shift-I (Re-Exam)

Ans. (c) : Tungsten due to its high melting point and excellent electrical conductivity is widely used in high-temperature applications.

- High melting point (3414ºC) and low coefficient of expansion properties of Tungsten makes it particularly suitable for use in electrical components like filaments and electrodes in high-temperature environments.
- Tungsten has highest tensile strength, high density (19.3 g/cm^3)
- It has good thermal and electrical conductivity but it is brittle at room temperature.

2. Which of the following materials is typically preferred for electrical conductors due to its high conductivity and resistance to corrosion?

(a) Manganin
(b) Gold
(c) Steel
(d) Copper

RRB JE 22.04.2025, Shift-II (Cancelled)

Ans. (d) : Copper is typically preferred for electrical conductors due to its high conductivity and resistance to corrosion.

- Copper has high electrical conductivity, good mechanical strength, excellent resistance to corrosion and cost-effectiveness.

3. Which of the following describes the effect of hardening in conducting materials such as copper and aluminium?

(a) It increases ductility and reduces resistance
(b) It reduces electrical conductivity and increases brittleness
(c) It has no effect on the material's electrical properties
(d) It increases hardness and tensile strength, but reduces ductility

RRB JE 22.04.2025, Shift-II (Cancelled)

Ans. (b) : When conducting materials like copper and aluminium are hardened, the following happens-

- Increases brittleness (break or fracture suddenly under stress).
- Electrical conductivity decreases.

4. Manganin is a copper-manganese alloy that is widely used in precision resistors and temperature-sensitive applications. Which of the following properties makes manganin particularly useful in these applications?

(a) High tensile strength and ductility
(b) High electrical conductivity
(c) Low temperature coefficient of resistance
(d) High thermal coefficient of resistance

RRB JE 22.04.2025, Shift-I

Ans. (c) : Manganin is a copper-manganese alloy that is widely used in precision resistor and temperature sensitive application. The low temperature coefficient of resistance properties makes Manganin particularly useful in these applications.

5. Which of the following is a primary characteristic of low resistivity materials used in electrical conductors?

(a) High insulation properties and poor conductivity
(b) High thermal resistance and poor conductivity
(c) High cost and low flexibility
(d) High conductivity and low resistivity

RRB JE 22.04.2025, Shift-I

Ans. (d) : High conductivity and low resistivity is a primary characteristic of low resistivity material used in electrical conductors.

- Low resistivity material (such as copper or silver) are used in electrical conductors because they allow electric current to flow easily. This means they have High conductivity (they conduct electricity well) Low resistivity (they resister the flow of electric current very little).

6. What is the primary effect of the annealing process on conducting materials such as copper and aluminium?

(a) It increases tensile strength and hardness.
(b) It causes oxidation of the material's surface.
(c) It reduces electrical resistance by decreasing the number of dislocations.
(d) It increases the material's brittleness.

RRB JE 22.04.2025, Shift-I

Ans. (c) : The primary effect of the annealing process on conducting materials such as copper and aluminium is that it reduces electrical resistance by decreasing the number of dislocations.

- When dislocations are reduced, electrons can flow more freely.
- Annealing is a heat treatment process applied to metals like copper and aluminium.

7. The most commonly used electrical conductor is–

(a) Lead (b) Copper
(c) Brass (d) Tin

RRB JE- 01.09.2019
RRB Bhubaneswar JE-II 29.11.2008

Ans. (b) : The most commonly used electrical conductor is copper. Copper is a metal which has high conductivity and low resistivity.

- It is easily available.
- Resistivity of copper is 1.77×10^{-8} ohm-meter.
- Melting point of copper is 1084ºC.

8. Which material has the highest electrical conductivity?

(a) Aluminium (b) Steel
(c) Silver (d) Lead

RRB JE 31.08.2019
RRB Mumbai 2015

Ans. (c) : Silver has the highest electrical conductivity. It is a conducting material with a large number of free electrons. Due to large number of free electron it has a high electrical conductivity. The resistivity of silver is 1.59×10^{-8} Ωm and the conductivity is $6.29\times10^{7}\ \Omega^{-1}m^{-1}$

9. A conductor is said to be perfect if it has _____ electrical conductivity.

(a) Zero (b) Finite
(c) Infinite (d) Unity

RRB JE 31.08.2019

Ans. (c) : A conductor is said to be perfect if it has infinite electrical conductivity. Conductor are those substances in which the number of free electron is very high ($\sim 10^{22}$ per unit volume)
Silver is the best conductor of electricity because it contains a higher number of free electrons.

10. A material is said to have become superconductor when

(a) its resistance becomes negative
(b) its resistance becomes very small
(c) its resistance decreases
(d) its resistance becomes zero

RRB SSE Bilaspur Yellow paper, 21.12.2014

Ans : (d) A material is said to have become superconductor when its resistance becomes zero. A superconductor is a material that attains, Superconductivity a state of matter with no electrical resistance. In a superconductor an electric current can persist indefinitely.

For Superconducting material (μ_r) = 0, Susceptibility (χ) = Negative,

11. Which of the following material has the highest electrical conductivity?

(a) Gold (b) Silver
(c) Copper (d) Aluminium

RRB Chennai technical (Engg.) 15.04.2007

Ans. (b) : A conductor is a material which gives very little resistance to the flow of an electric current.
Silver has the highest electrical conductivity out of all material. The decreasing order of conductivity is Silver > Copper > Gold > Aluminium.

12. 5×10^{16} electrons pass across the section of a conductor in 1 minute 20 sec. The current flowing is :

(a) 1 mA (b) 0.1 mA
(c) 0.01 mA (d) 10 mA

RRB SSE (shift-III), 02.09.2015

Ans : (b) $Q = it$ and $Q = ne$ where $e = 1.6\times10^{-19}$ C

$$i = \frac{ne}{t} \Rightarrow \frac{5\times10^{16}\times1.6\times10^{-19}}{80} = 0.1\text{mA}$$

13. _____Are usually found in the nucleus of an atom

(a) Proton and Neutron
(b) Proton and Electron
(c) Electron and Neutron
(d) Only Neutron

RRB Ajmer Electronic – 2014

Ans : (a) Generally, the nucleus of an atom consists of protons and neutrons. Electrons in revolve in outside the nucleus.

14. Which of the following is not one of the effects of rise in temperature on resistance?

(a) Decrease in the resistance of pure metals
(b) Increase in the resistance of alloys
(c) Decrease in the resistance of electrolytes, insulators, etc.
(d) Increase in the resistance of pure metals

RRB Jammu JE-25.10.2009
DFCCIL Executive (EE) -30.09.2021

Ans.(a): Pure metal (conductor) has positive temperature coefficient i.e. when temperature increases, resistance also increases.

15. The composition of constantan is:

(a) Cu = 60% and Ni = 40%
(b) Cu = 43%, Ni = 17% and Mn = 40%
(c) Sn = 23.43%, Cu = 43.67% and Ni = 32.9%
(d) Mn = 65% and Zn = 35%

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM
DMRC Electronics 17.02.2017, 12:00 – 2:15 PM
Delhi Metro Electronics JE 2017
RRB Bhopal SSE 24.11.2002

Ans. (a) : Constantan:- It is a copper and nickel alloy used in the production of thermocouples and thermocouple extension wire as well as precision resistor and two temperature resistance heating application.
Constantan = Cu (60%) + Ni (40%)

16. Metal film resistors are made by depositing a very thin layer of metal on–

(a) Metal rod (b) Bakelite sheet
(c) Ceramic rod (d) Metal sheet

RRB Bhubaneswar JE-II 29.11.2008

Ans : (b) Metal film resistors are made by depositing a very thin layer of metal on Bakelite Sheet.

17. In the superconducting state, the flux lines of a magnetic field are ejected out of the superconductor as per-

(a) Curie effect (b) Faraday's effect
(c) Maxwell's effect (d) Meissner effect

RRB Chandigarh SSE 15.03.2009

Ans. (d) : In the superconducting state the flux lines of a magnetic field are ejected out of the super conductor as per Meissner effect. The Meissner effect is a property of all superconductor was discovered by the German Physicists W. Meissner and R. Ochsenfeld in 1933.

18. The usual matter of soldering is

(a) Steel alloy
(b) White metal
(c) Alloy of lead and tin
(d) Alloy of copper and zinc

RRB Bhubaneswar JE-II, 19.12.2010

Ans. (c) : The usual matter of soldering is alloy of lead and tin. Those alloys which work to join two or more metallic pieces or small work item by melting themselves due to heat that is called solder material.

1. Tin and lead less than soft solder (melting point 40ºC)
2. Hard solder - melting point above 400ºC

(a) Brass solder - Copper + Zinc
(b) Silver solder - Copper + silver

19. Which of the following lists four platinum, silver, aluminium and copper in increasing order of resistivity?

(a) Platinum, Aluminium, Copper, Silver
(b) Silver, Copper, Platinum, Aluminium
(c) Copper, Silver, Aluminum, Platinum
(d) Silver, Copper, Aluminium, Platinum

Noida Metro Electronic JE 2017, SAIL 29.3.2014
RRB Allahabad JE-19.12.2010

Ans : (d)

Material	Resistivity (Ω-m)
Silver	1.59×10^{-8}
Copper	1.68×10^{-8}
Gold	2.4×10^{-8}
Aluminium	2.88×10^{-8}
Tungsten	5.6×10^{-8}
Platinum	10.6×10^{-8}

Increasing order of resistivity -
Silver, Copper, Aluminium, Platinum.

20. Silver tungsten contact material has _____thermal and electrical conductivity.

(a) zero (b) low
(c) medium (d) high

UPMRCL JE 03.01.2023, 1:30 PM- 3:30 PM

Ans. (d) : Silver tungsten contact material has high thermal and electrical conductivity.

21. The correct sequence of increasing order of electrical resistivity of the given material is-

(a) Diamond, Silicon, Gold, Doped germanium
(b) Gold, Silicon, Doped germanium, Diamond
(c) Gold, Doped germanium, Silicon, Diamond
(d) Gold Diamond, Doped germanium, Silicon

Konkan Railway TA-2017

Ans. (c) : Electrical resistivity (also called specific electrical resistance or volume resistivity) and it is reciprocal of electrical conductivity, and it is a fundamental property of a material that identifies how strongly it resists of the electric current. The SI unit of electrical resistivity is the ohm-meter. Increasing order of electrical resistivity of materials. Gold, Doped Germanium, Silicon, Diamond.

22. The best definition of a superconductor is:

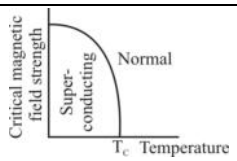
(a) It is a material showing perfect conductivity and Meissner effect below a critical temperature
(b) It is conductor having zero resistance
(c) It is a perfect conductor with highest diamagnetic susceptibility
(d) It is a perfect conductor but becomes resistive when the current density through it exceeds a critical value

BMRCL JE 24.02.2019

Ans : (a) A superconductor is a material that achieve superconductivity which is a state of matter that has no electrical resistance and does not allow magnetic field to penetrate.
Superconductor is a material showing perfect conductivity and Meissner effect below a critical temperature.
Effect of magnetic field on superconductivity -

$$H_c = H_{c(0)}\left[1-\left(\frac{T^2}{T_c^2}\right)\right]$$

H_c = critical value of magnetic field
$H_{c(0)}$ = critical magnetic field at 0K
T_c = critical temperature



23. _____is a weak electron - electron bond pair mediated by a phonon interaction.

(a) Electron pair (b) Cooper pair
(c) Ion pair (d) Fermions pair

UPMRCL JE (S&T) 03.01.2023,1:30-3:30PM

Ans. (b) : Cooper pair is a weak electron - electron bond pair mediated by a phonon interaction.

Electron-phonon interaction- The electron-phonon interaction is one of the cornerstones of condensed matter physics. It is a major scattering mechanism that limits charge carrier mobility in bulk semiconductor.

24. Pure Metals generally have:

(a) High Conductivity and Low temperature coefficient
(b) High Conductivity and High temperature coefficient
(c) Low Conductivity and zero temperature coefficient
(d) Low Conductivity and High temperature coefficient

RRB Allahabad SSE 19.12.2010

Ans : (b) Pure metal generally have high conductivity and high temperature co-efficient. Pure metal has low value of specific resistance and high value of conductivity. It has positive temperature co-efficient.

25. Which of the following is not one of the effects of rise in temperature on resistance?

(a) Decrease in the resistance of pure metals
(b) Increase in the resistance of alloys
(c) Decrease in the resistance of electrolytes, insulators, etc.
(d) Increase in the resistance of pure metals

DFCCIL Executive (EE) -30.09.2021

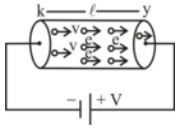
Ans.(a): Pure metal (conductor) has positive temperature coefficient i.e. when temperature increases, resistance also increases.

26. Charge velocity is defined as the:

(a) Speed with which the effect of EMF is experienced at all parts of the conductor resulting in the flow of current
(b) Electrons moving at the Fermi speed
(c) Speed with which charge drifts in a conductor
(d) Holes moving at the Fermi speed

DFCCIL Executive (EE) -30.09.2021

Ans. (c) : Charge velocity- The speed of charged flows in a conductor is called charge velocity.



$$V_d = \frac{I}{neA}$$

Where, I = flowing current
n = Electron density
e = Charge of electron
A = Area of cross section.

27. Which of the following is true for resistance of a conductor?

(a) It is directly proportional to its length
(b) It is directly proportional to the area of cross section of the conductor
(c) It is independent of nature of the material
(d) It is independent of temperature of conductor

LMRC JE (S&T) 12.05.2018

Ans. (a) : Resistance: The property of any conductor that opposes the flow of electric current through is called resistance.

It is denoted by 'R' and the SI unit is the Ohm (Ω)

The resistance is given by; $R = \rho\frac{\ell}{A}$

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

∴ Resistance of a conductor varies directly proportional to its length and inversely proportional to the area of cross section of conductor.

28. Materials in which large number of free electrons are available in outermost orbit are called :

(a) Semiconductors (b) Conductors
(c) Insulators (d) Magnetic materials

DMRC Electronics 19.04.2018, 12:15 to 2:30 PM

Ans. (b) : The large number of free electrons are available in outermost orbit are called conductor.

Example- Cu, Ag, Al etc.

29. All conducting materials have a resistivity of less than

(a) $10^{-3}\,\Omega m$ (b) $10^{-2}\,\Omega m$
(c) $10^{-6}\,\Omega m$ (d) $10^{3}\,\Omega m$

DMRC Electronics 11.04.2018, 12:15 to 2:30 PM

Ans. (a) : All conducting materials have a resistivity of less than $10^{-3}\Omega$–m

- The electrical resistivity of particular conductor material is a measure of how strongly the material opposes the flow of electric current through it.

30. Which of the following has the largest number of free electrons?

(a) Intrinsic semiconductor
(b) Conductor
(c) Extrinsic semiconductor
(d) Insulator

UPMRC (SCTO) 14.04.2021

Ans. (b) : Conductors has largest number of free electrons. A conductor is a substance or material that allows electricity to flow through it. In a conductor, electrical charge carriers, usually electrons or ions, move easily from atom to atom when voltage is applied.

31. For a copper wire with circular cross sections (diameter = 1.03 mm) with resistivity $=2.5\times10^{-4}$ Ω-m. concentration of free $e^- = 8.4\times10^{28}/m^3$ and current density $=2.1\times10^6 A/m^2$, determine the mobility of electrons.

(a) $3.567\times10^{-3}m^2$/V-sec (b) $4.67\times10^{-2}m^2$/V-sec
(c) $2.173\times10^{-5}m^2$/V-sec (d) $1.542\times10^{-4}m^2$/V-sec

UPMRC JE- 20.01.2020, 4:00 to 6:00 PM

Ans. (*) :

$$d = 1.03 \text{ mm}$$

$$\therefore \quad r = \frac{1.03}{2} = 0.515 \text{mm}$$

$$\text{resistivity } (\rho) = 2.5\times10^{-4}\,\Omega\text{-m}$$

$$\therefore \text{ total, } \rho_T = 2.5\times10^{-4}\times\pi r^2$$

$$= 2.5\times10^{-4}\times\pi\times\left(0.515\times10^{-3}\right)^2$$

$$\rho_T = 2.083\times10^{-10}\,\Omega\text{-m}$$

$$n = 8.4\times10^{28}/m^3$$

$$\mu = \frac{1}{ne\rho_T}$$

$$= \frac{1}{8.4\times10^{28}\times1.6\times10^{-19}\times2.083\times10^{-10}}$$

$$= \frac{10^{(-28+19+10)}}{8.4\times1.6\times2.083}$$

$$= 0.03572\times10$$

$$\text{Mobility of electrons } (\mu) = 3.572\times10^{-1}\,m^2/V-\text{sec}$$

32. A conductor material has a free-electron density of 10^{25} electrons per m^3, When a voltage is applied, a constant drift velocity of 1.4×10^{-3} m/s. If the cross-sectional area of the material is 1 cm^2, calculate the magnitude of the current. Electronic charge is 1.6×10^{-19} coulomb.

(a) 0.224 A (b) 0.2 A
(c) 0.25 A (d) 0.1 A

DFCCIL Executive (EE) -30.09.2021

Ans. (a) : Given that,

Free-electron density $(n) = 10^{25}$ per m^3

Charge on electron $(e) = 1.6\times10^{-19}$ Coulomb

Cross section area $(A) = 1\ cm^2 = 1\times10^{-4}\ m^2$

Drift velocity $(V_d) = 1.4\times10^{-3}$ m/s

$$I = neAV_d$$

$$= 10^{25}\times1.6\times10^{-19}\times1\times10^{-4}\times1.4\times10^{-3}$$

$$\boxed{I = 0.224 \text{ A}}$$

33. Which of the following lists four platinum, silver, aluminium and copper in increasing order of resistivity?

(a) Platinum, Aluminium, Copper, Silver
(b) Silver, Copper, Platinum, Aluminium
(c) Copper, Silver, Aluminum, Platinum
(d) Silver, Copper, Aluminium, Platinum

NMRC Electronic JE 09.03.2017, SAIL 29.03.2014

Ans : (d)

Material	Resistivity (Ω-m)
Silver	1.59×10^{-8}
Copper	1.68×10^{-8}
Gold	2.4×10^{-8}
Aluminium	2.88×10^{-8}
Tungsten	5.6×10^{-8}
Platinum	10.6×10^{-8}

Increasing order of resistivity -
Silver, Copper, Aluminium, Platinum.

34. Superconductors now a day found their application in various fields. This is due to the fact that they:

(a) generate regions free from magnetic field
(b) manufacture bubble memories
(c) generate electrostatic field
(d) generate very strong magnetic field

DFCCIL EE 17.04.2016, Shift-II

Ans. (d) : Super conductor now a day found their application in various field. This is due to the fact that they generate very strong magnetic field.
Such substances or metal in which the value of resistivity decrease very rapidly at a certain temperature become zero. These substances or metal are called superconducting substances and this property is called superconductivity.
Superconductor generate high electromagnetic field so, they are used in magnetic resonance imagining and nuclear magnetic resonance.

35. The magnitude of critical density in a superconductor depends on:

(a) Both temperature and magnetic field strength
(b) temperature for some time and then on magnetic field strength
(c) temperature
(d) magnetic field strength

DFCCIL EE 17.04.2016, Shift-II

Ans. (a) : The magnitude of critical density in a super conductor depend on both temperature and magnetic field strength. The critical field generally increases to absolute zero as the temperature decreases.

36. A material is said to have become superconductor when

(a) its resistance becomes negative
(b) its resistance becomes very small
(c) its resistance decreases
(d) its resistance becomes zero

RRB SSE Bilaspur Yellow paper, 21.12.2014
JMRC JE-2013

Ans : (d) A material is said to have become superconductor when its resistance becomes zero. A superconductor is a material that attains, Superconductivity a state of matter with no electrical resistance. In a superconductor an electric current can persist indefinitely.

For Superconducting material (μ_r) = 0, Susceptibility (χ) = Negative,

37. The transition temperature of superconductivity material titanium is :

(a) 1.17 K (b) 14 K
(c) 9.2 K (d) 0.49 K

UPMRCL JE 03.01.2023, 1:30 PM- 3:30 PM

Ans. (d) : Titanium is superconducting material when cooled below its critical temperature of 0.49K.

38. The current carrying capacity of aluminium is what percent of the carrying capacity of copper?

(a) 15% (b) 30%
(c) 75% (d) 25%

UPMRCL JE 03.01.2023, 1:30 PM- 3:30 PM

Ans. (c) : The percentage current carrying capacity of Aluminum is 75 % of current carrying capacity of copper.

Current carrying capacity- Current carrying capacity of a conductor is defined as how much load a conductor can carry. When the current flows through the conductor a certain level of heat generates which can further increases up-to the melting temperature of the insulation or insulating material.

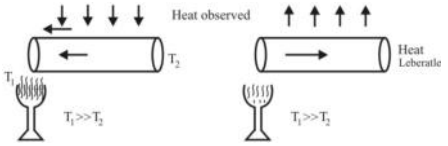
These factors are-
- Conductor size
- Ambient temperature
- Installation conditions.

39. If a piece of metal is made to have a temperature gradient between its two ends, an emf is observed to exist between those ends. This effect is known as :

(a) Thomson effect (b) Seebeck effect
(c) Peltier effect (d) Thevenin effect

LMRC SCTO (Electronics) 16.04.2018, Shift-II

Ans. (a) : If a piece of metal is made to have a temperature gradient between its two ends an emf is observed to exist between those ends. This effect is known as Thomson effect.



40. When a material becomes super conducting then its resistivity is

1. Very low
2. Zero
3. Approximate 10% of normal value
4. Approximate 20% of normal value

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

RRB JE (Shift-3), 28.08. 2015, AAI 26.4.2015

Ans : (b) The resistivity of super conducting materials becomes zero. Superconducting materials have most of the free electrons and minimum resistivity.

41. The material of wires used for making standard resistances is usually:

(a) Manganin (b) Phosphor Bronze
(c) Nichrome (d) Copper

DFCCIL EE 11.11.2018, 12:30 PM–2:30 PM
JMRC JE 10.06.2017

Ans. (a) : The material of wires used for making standard resistances is usually manganin. Manganin is an alloy of copper, nickel and manganese. Alloy like manganin and constantan are used for making standard resistance coil as they have high resistivity and a low-temperature co-efficient of resistance.

(ii) Semiconductor & Insulators

42. Hydrogen is used as an insulating gas in electrical equipment. What is the main reason for its use in such applications?

(a) It is a good conductor of electricity.
(b) It has a high dielectric strength and low molecular weight.
(c) It is stable at high temperatures
(d) It has a high molecular density

RRB JE 04.06.2025, Shift-I (Re-Exam)

Ans. (b) : Hydrogen is used as an insulating gas in electrical equipment. It has a high dielectric strength and low molecular weight (2.016 g/mol).

43. Which of the following best describes a semiconductor material?

(a) A material that behaves as a conductor at low temperatures and as an insulator at high temperatures.
(b) A material that only conducts electricity at high temperatures.
(c) A material that allows electric current to pass freely in both directions.
(d) A material that can conduct electricity under certain conditions but not others.

RRB JE 04.06.2025, Shift-I (Re-Exam)

Ans. (d) : A semiconductor is a material that conducts electricity only under certain conditions such as increased temperature, light or impurity doping.
- Electrical conductivity of a semiconductor material lies between a conductor and an insulator.
- The conductivity can be increased by adding small amounts of impurities to form n-type and p-type semiconductors.

44. Which of the following is a commonly used thermosetting resin in electrical applications due to its excellent electrical insulating properties and resistance to high temperatures?

(a) Polystyrene (b) Epoxy resin
(c) Polyethylene (d) Polyvinyl chloride

RRB JE 04.06.2025, Shift-I (Re-Exam)

Ans. (b) : Epoxy resin is a commonly used thermosetting resin in electrical applications due to its excellent electrical insulating properties and resistance to high temperatures.
- Epoxy resin is a thermosetting resin which provides excellent electrical insulation.
- It has high thermal stability.
- It is also chemically resistant.

45. Which of the following statements about extrinsic semiconductors is correct regarding the effect of temperature on their conductivity?

(a) In p-type semiconductors, increasing the temperature leads to an increase in the number of holes as more electrons get excited to the conduction band.