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CLASS 10

Physics SLO Based

Chapter No.16

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SLO Based Important Questions
Chapter No. 16
INTRODUCTORY ELECTRONIC

Q1: Define "Electronic"?
Ans: Electronic:
The term "electronic" refers to anything related to or operating through the control of electric currents or signals. It encompasses the study, design, and application of devices, systems, and components that use the behavior and effects of electrons and other charged particles.

Q2: What is thermionic emission?
Ans: Thermionic Emission:
The process by which electrons are emitted from a heated surface or a hot filament. When a material is heated to a sufficiently high temperature, the thermal energy can provide enough energy for some of the electrons within the material to overcome the attractive forces of the material's atoms or ions and escape into the surrounding space.
Explanation:
In thermionic emission, the source of heat is typically an electrically heated filament, often made of a refractory metal like tungsten, which is heated to a high temperature. The high temperature causes the electrons in the filament to gain sufficient energy to break free from the surface and become free electrons.

Q3: Define free electrons.
Ans: Free Electrons:
Free electrons are the electrons that are not bound to any specific atom and are capable of moving freely within a material. It is only the outermost "Valence" electrons that are somewhat free and termed as Free Electrons.

Q4: How to define the term "Work Function"?
Ans: Work Function:
The minimum amount of energy required to remove an electron from a material or surface.
Explanation:
When an external energy source, such as light or an electric field, interacts with a material, electrons can be excited and potentially escape the material's surface. However, each material has a certain threshold energy, the work function, that must be overcome for electrons to be emitted.

Q5: How does an electron gun work?
Ans: Electron Gun:
An electron gun is a device that generates and focuses a beam of electrons. It is commonly used in various applications, including cathode ray tubes (CRTs), electron microscopes, particle accelerators.
Construction:
The electron gun typically consists of several key components: -
Cathode:
The cathode is a heated filament that emits electrons through thermionic emission. The cathode is the electron source, where electrons are generated.
Anode:
The anode is a positively charged electrode that accelerates the emitted electrons towards a specific direction. The anode attracts and focuses the electron beam.

Control electrodes:
The electron gun may include one or more control electrodes, such as grids, that shape and control the electron beam. These electrodes can adjust the beam's intensity, focus, or deflection.
Accelerating voltage:
The electron gun is typically connected to a high voltage power supply that provides the necessary potential difference to accelerate the electrons towards the anode. This voltage determines the energy of the electrons in the beam.

Q6: What are cathode rays?
Ans: Cathode Rays:
Cathode rays are beams of electrons that are emitted from the cathode and move towards the anode in a cathode ray tube.

Q7: Explain the deflection of cathode rays by an electric field.
Ans: Deflection by Electric Field:
Cathode rays can be deflected by an electric field because they are negatively charged. The electric field exerts a force on the electrons, causing them to be deflected towards the positive plate.

Q8: How are cathode rays deflected by a magnetic field?
Ans: Deflection by Magnetic Field:
Cathode rays are deflected by a magnetic field because they are charged particles. The magnetic field exerts a force on the moving electrons, causing them to change their path. Flemming's Right Hand Rule can be used for the direction of deflected cathode Rays.

Q9: What is a cathode ray oscilloscope and its uses?
Ans: Cathode Rays Oscilloscope (CRO):
A cathode ray oscilloscope is an electronic instrument used to display and analyze the waveform of electrical signals.
Uses:
It is commonly used in electronic laboratories and engineering fields for various purposes such as signal measurement, waveform observation, and troubleshooting electronic circuits.

Q10: Explain the structure of Cathode Ray Oscilloscope (CRO)?
Ans: Structure of CRO:
The basic structure of a CRO includes the following components: -
Cathode Ray Tube (CRT):
The CRT is a vacuum tube with a fluorescent screen that emits light when struck by an electron beam. It consists of an electron gun, focusing and deflection systems, and a screen. The electron beam inside the CRT is generated by the electron gun and can be deflected by the applied electrical signals.
Vertical and Horizontal Deflection Plates:
These plates are responsible for deflecting the electron beam horizontally and vertically, allowing the display of signals on the CRT screen. The deflection plates are controlled by the input electrical signals, which produce the waveform on the screen.
Controls and Adjustments:
CROs have various controls and adjustments to adjust the amplitude, time base, triggering, and other parameters of the displayed waveform. These controls allow users to customize the display according to the specific requirements of the signal being analyzed.

Q11: Differentiate between Analogue and Digital quantities?
Ans: Analog Quantities:
Analog quantities are continuous and can take on any value within a certain range. They can have an infinite number of possible values.
Example:
Examples of analog quantities include continuous physical measurements such as voltage, current, temperature, pressure, and sound waves.
Digital Quantities:
Digital quantities are discrete and can only take on specific, distinct values. They have a limited number of possible values, often represented as binary digits (bits), typically 0 or 1. Digital quantities are used to represent and manipulate information in digital systems.
Example:
For example, computers and digital communication systems.

Q12: Differentiate between analogue and digital electronics.
Ans: Analogue Electronics:
Analogue electronics deals with continuous signals and quantities.
Digital Electronics:
Digital electronics deals with discrete signals and quantities represented by binary digits (0 and 1).

Q13: How does thermionic emission contribute to the operation of a vacuum tube?
Ans: Thermionic emission is essential for the operation of a vacuum tube. It allows the emission of electrons from a heated cathode, which then flow towards the anode, enabling the amplification or control of electrical signals within the vacuum tube.

Q14: What factors can affect the rate of thermionic emission?
Ans: Factors of Thermionic Emission:
The rate of thermionic emission can be influenced by factors such as the temperature of the cathode, the material of the cathode, and the presence of impurities or coatings on the cathode surface.

Q15: Explain the concept of electron mobility in a material.
Ans: Electron Mobility:
Electron mobility refers to the ease with which electrons can move through a material when subjected to an electric field. It is a measure of how quickly and efficiently electrons can travel in response to an applied voltage.

Q16: How does a cathode ray tube (CRT) work?
Ans: Cathode Ray Tube (CRT):
A cathode ray tube consists of a cathode and an anode, with a vacuum in between. When a high voltage is applied, the cathode emits electrons (cathode rays) which are accelerated towards the anode. These electrons create a visible light or an image on the screen of the CRT.

Q17: What is the purpose of a deflection plate in a cathode ray tube?
Ans: Purpose of Deflection Plate:
The deflection plates in a cathode ray tube are used to control the path of the electron beam. By applying electric fields to the deflection plates, the electron beam can be drive and redirected to different positions on the screen.

Q18: Describe the working principle of a cathode ray oscilloscope.
Ans: Working Principle of CRO:
A cathode ray oscilloscope works by deflecting a focused beam of electrons (cathode rays) using electric fields. These deflected electrons create a visual representation of an electrical signal on a screen, allowing for the observation and analysis of the signal's waveform and characteristics.

Q19: What are logic gates? Provide examples of logic gates.
Ans: Logic Gates:
Logic gates are electronic devices that perform logical operations on one or more binary inputs and produce a single binary output based on their input values.
Example:
Examples of logic gates include the AND gate, OR gate, and NOT gate.

Q20: What is the purpose of an automatic light bulb switching system using logic gates?
Ans: The purpose of an automatic light bulb switching system using logic gates is to control the operation of a light bulb based on specific conditions or inputs. It allows for automated switching of the light bulb depending on the desired logic conditions.

Q21: Explain the concept of a Boolean equation.
Ans: Boolean Equation:
A Boolean equation is a mathematical representation of a logical relationship between variables using logical operators such as AND, OR, and NOT. It expresses the conditions and relationships that need to be satisfied for the equation to be true.

Q22: What is a truth table?
Ans: Truth Table:
A truth table is a tabular representation that shows all possible combinations of inputs and their corresponding outputs for a logical function or operation. It helps in understanding the behavior and outcomes of logic gates or Boolean equations.

Q23: What is the role of logic gates in digital electronic circuits?
Ans: Role of Logic Gates:
Logic gates are fundamental building blocks of digital electronic circuits. They process binary inputs according to logic rules and produce binary outputs. Logic gates are used to perform logical operations, manipulate and control binary data, and implement various digital functions and systems.

Q24: Explain the operation of an AND gate and provide its truth table.
Ans: Boolean Expression:
The Boolean expression for a AND gate with two inputs, A and B, is: -
X = A × B

Truth Table:

A	B	X (Output)
0	0	0
0	1	0
1	0	0
1	1	1

Logic Statement of AND Gate:
An AND gate is a logic gate that produces an output of 1 (high) only when all of its inputs are 1 (high). The output is 0 (low) if any input is 0 (low).

Q25: Explain the operation of an OR gate and provide its truth table.
Ans: Boolean Expression:
The Boolean expression for a OR gate with two inputs, A and B, is: -
X = A + B

Truth Table:

A	B	X (Output)
0	0	0
0	1	1
1	0	1
1	1	1

Logic Statement of OR Gate:
An OR gate is a logic gate that produces an output of 1 (high) if any of its inputs is 1 (high). The output is 0 (low) only when all inputs are 0 (low). It performs the logical OR operation.

Q26: Explain the operation of an NOT gate and provide its truth table.
Ans: Boolean Expression:
The Boolean expression for a NOT gate with one inputs, A is: -
X = A`

Truth Table:

A	X (Output)
0	1
1	0

Logic Statement of NOT Gate:
A NOT gate (also known as an inverter) is a logic gate that produces an output that is the complement of its input. If the input is 0 (low), the output is 1 (high), and vice versa.

Q27: Explain the operation of a NAND gate and provide its truth table.
Ans: Boolean Expression:
The Boolean expression for a NAND gate with two inputs, A and B, is: -
X = (A × B) `

Truth Table:

A	B	X (Output)
0	0	1
0	1	1
1	0	1
1	1	0

Logic Statement of NAND Gate:
A NAND gate is a logic gate that produces an output of 0 (low) only when all of its inputs are 1 (high). Otherwise, the output is 1 (high). It is equivalent to an AND gate followed by a NOT gate.

Q28: Explain the operation of an NOR gate and provide its truth table.
Ans: Boolean Expression:
The Boolean expression for a NOR gate with two inputs, A and B, is: -
X = (A + B) `

Truth Table:

A	B	X (Output)
0	0	1
0	1	0
1	0	0
1	1	0

Logic Statement of NOR Gate:
A NOR gate, produces an output of 1 (high) only when all inputs are 0 (low). Otherwise, the output is 0 (low).

Q29: Define Boolean algebra.
Ans: Boolean Algebra:
Boolean algebra is a mathematical system that deals with variables and logical operations, including AND, OR, and NOT. It provides a formalized way to manipulate logical statements and expressions, which can be used to design and analyze digital electronic circuits.

Q30: What is the purpose of a NOT gate in digital circuits?
Ans: NOT Gate:
The purpose of a NOT gate is to invert the input signal. It produces an output that is the logical opposite (complement) of the input signal.
Example:
If the input is high (1), the output is low (0), and vice versa.

Q31: If there are 2 inputs in any logic gate, how many combinations are possible?
Ans: If there are 4 inputs in any logic gate, there are 4 possible combinations.
General Relation:
2^n .....(1)
As n = 2
Using value in equation (1)
2^2
4
Each input can either be 0 or 1, resulting in 2 possible states, and with 2 inputs, the total number of combinations is: -
2 × 2 = 4.

Q32: If there are 6 inputs in any logic gate, how many combinations are possible?
Ans: If there are 4 inputs in any logic gate, there are 64 possible combinations.
General Relation:
2^n .....(1)
As n = 6
Using value in equation (1)
2^6
64
Each input can either be 0 or 1, resulting in 2 possible states, and with 6 inputs, the total number of combinations is: -
2 × 2 ×2 × 2 × 2 × 2 = 64.

Q33: What conditions produce a high (1) output for an AND gate and NOR gate?
Ans: AND Gate:
A high output (1) is produced only when all the inputs are high (1). If any of the inputs are low (0), the output will be low (0).
NOR Gate:
A high output (1) is produced only when all the inputs are low (0). If any of the inputs are high (1), the output will be low (0).

Q34: What are the algebraic Boolean expressions to represent the output of AND, OR, NOT, NAND, and NOR gates?
Ans:
AND Gate:
Output = **A × B**
(Where '×' represents the AND operation)
OR Gate:
Output = **A + B**
(Where '+' represents the OR operation)
NOT Gate:
Output = **A`**
NAND Gate:
Output = **(A × B) `**
(NAND is the combination of AND and NOT operations)
NOR Gate:
Output = **(A + B) `**
(NOR is the combination of OR and NOT operations)

Q35: How can logic gates be used in a textile coloring plant?
Ans: Textile Coloring Plant:
Logic gates can be employed in a textile coloring plant to control and automate the process of coloring fabrics. They can be utilized to monitor and regulate various parameters such as temperature, pH levels, dye flow, and timing, ensuring precise and efficient coloring operations.

Q36: What is the relationship between logic gates and Boolean equations?
Ans: Logic gates can be used to implement and realize Boolean equations. Boolean equations express logical relationships between variables using logical operators. Logic gates provide a physical or electronic implementation of these equations by performing the corresponding logical operations.

Q37: What is the significance of a truth table in the design of logic circuits?
Ans: Significance of Truth Table:
Truth tables play a crucial role in the design of logic circuits. They help in determining the output values for all possible input combinations, enabling the analysis and verification of circuit behavior, identification of logical relationships, and simplification of complex logic expressions.

Q38: Discuss the concept of Boolean logic and its applications in electronic circuits.
Ans: Boolean logic is a system of logic that deals with variables and logical operations based on the principles of true (1) and false (0). It forms the foundation of digital electronic circuits, allowing the manipulation, control, and processing of binary data and signals. Boolean logic finds applications in computer systems, electronic devices, and communication networks.

Q39: How do logic gates contribute to the development of digital computers?
Ans: Logic gates are the building blocks of digital computers. They are used to perform calculations, execute logical operations, and store and process data within the computer's circuits and components. Logic gates enable the execution of complex tasks and the creation of intricate computational systems.

Q40: What are the primary inputs and outputs of a logic gate?
Ans: Input:
The primary inputs of a logic gate are the input signals or variables that determine its output.
Output:
The outputs of a logic gate are the resulting signals or values produced based on the logical operations performed on the input signals.

Q41: Describe the working principle of a digital-to-analogue converter (DAC).
Ans: Digital-to-Analogue converter (DAC):
A digital-to-analogue converter (DAC) is a device that converts digital signals into analogue signals. It takes binary input data and generates an output voltage or current that represents the digital information in continuous form.

Q42: Describe the working principle of analogue-to-digital converter (ADC).
Ans: Analogue-to-Digital converter (ADC):
An analog-to-digital converter (ADC) is a device that converts continuous analog signals into discrete digital representations. It allows analog signals, such as voltage or current, to be processed and manipulated in digital systems, such as microcontrollers, computers, or digital signal processors.

Q43: How can logic gates be used in security systems?
Ans: Use of Logic Gates in Security System:
Logic gates can be utilized in security systems to implement access control, alarm triggering, and authentication mechanisms. They can process inputs from sensors, perform logical operations based on activate appropriate responses, such as activating alarms or granting access.

Q44: How can logic gates be utilized in traffic light control systems?
Ans: Logic gates can be employed in traffic light control systems to manage the timing and sequencing of traffic signals based on various inputs and conditions. They can process information from sensors, timers, and traffic flow detectors to control the appropriate signals for different lanes and intersections.