

Semiconductor Electronics — Assignment 1

Class 12 Physics · Topic-wise question bank covering every concept of the chapter · Narayan Gurukul Academy

Instructions: (1) Attempt all questions. This worksheet walks through every concept of the chapter, topic by topic.
 (2) The interactive MCQ version of these questions (with instant answer reveal) is available on the notes page.
 (3) Universal values: $g = 10 \text{ m/s}^2$ unless stated. Give answers with correct SI units.

Energy Bands and Doping

MCQ Questions (choose the correct option)

- In an intrinsic semiconductor at absolute zero, the valence band is
 - completely filled and the conduction band empty
 - partly filled
 - empty
 - overlapping with the conduction band
- The energy gap of a semiconductor is of the order of
 - 1 eV
 - 10 eV
 - 0 eV
 - 100 eV
- An n-type semiconductor is obtained by doping with a
 - pentavalent impurity
 - trivalent impurity
 - monovalent impurity
 - tetravalent impurity
- In a p-type semiconductor, the majority charge carriers are
 - holes
 - electrons
 - protons
 - neutrons

1 Mark Questions

- What is a semiconductor?
- What is the order of the energy gap of a semiconductor?
- Name the majority charge carriers in a p-type semiconductor.

2 Mark Questions

- Distinguish between intrinsic and extrinsic semiconductors.
- Explain how doping with a pentavalent impurity produces an n-type semiconductor.

3 Mark Questions

- Draw the energy band diagrams of conductors, insulators and semiconductors and explain the differences.
- Explain the formation of n-type and p-type semiconductors with suitable energy band diagrams.

P-N Junction and Diode

MCQ Questions (choose the correct option)

1. A p-n junction is formed by
 - (A) joining a p-type and an n-type semiconductor
 - (B) doping silicon with carbon
 - (C) heating a metal
 - (D) cooling a semiconductor
2. In forward bias, the p-n junction diode
 - (A) conducts
 - (B) does not conduct
 - (C) acts as an insulator
 - (D) emits light only
3. The depletion region of a p-n junction contains
 - (A) immobile ions
 - (B) free electrons
 - (C) free holes
 - (D) nothing
4. The barrier potential of a silicon p-n junction diode is about
 - (A) 0.7 V
 - (B) 0.3 V
 - (C) 1.1 V
 - (D) 5 V

1 Mark Questions

1. What is a p-n junction?
2. What is the barrier potential of a silicon diode?
3. Why does a p-n junction diode not conduct in reverse bias?

2 Mark Questions

1. Explain the formation of a depletion region and the potential barrier in a p-n junction.
2. Draw the I-V characteristics of a p-n junction diode in forward and reverse bias.

3 Mark Questions

1. Explain the working of a p-n junction diode in forward and reverse bias and draw its I-V characteristics.
2. Describe the formation of a p-n junction, showing the depletion layer, and explain how the diode acts as a one-way valve.

Rectifiers, LED, Photodiode and Solar Cell

MCQ Questions (choose the correct option)

1. A half-wave rectifier uses
 - (A) one diode
 - (B) two diodes
 - (C) four diodes
 - (D) three diodes
2. A full-wave bridge rectifier uses

- (A) four diodes
 - (B) one diode
 - (C) two diodes
 - (D) three diodes
3. An LED converts
- (A) electrical energy into light
 - (B) light into electricity
 - (C) heat into light
 - (D) light into heat
4. A photodiode is operated in
- (A) reverse bias
 - (B) forward bias
 - (C) both biases
 - (D) no bias

1 Mark Questions

1. What is a rectifier?
2. What is the function of an LED?
3. In which bias is a photodiode operated?

2 Mark Questions

1. Explain the working of a half-wave rectifier.
2. Explain how an LED works and give one of its uses.

3 Mark Questions

1. Explain the working of a full-wave bridge rectifier and draw the input and output waveforms.
2. Describe the working of a photodiode and a solar cell, stating one use of each.

Transistors and Amplification

MCQ Questions (choose the correct option)

1. A transistor has
 - (A) three terminals
 - (B) two terminals
 - (C) four terminals
 - (D) one terminal
2. The emitter of a transistor is
 - (A) heavily doped
 - (B) lightly doped
 - (C) moderately doped
 - (D) undoped
3. The current gain of a common-emitter amplifier is the ratio of
 - (A) the collector current to the base current
 - (B) the emitter current to the base current
 - (C) the base current to the collector current

- (D) the collector current to the emitter current
4. In a common-emitter amplifier, the base-emitter junction is
- (A) forward biased
 - (B) reverse biased
 - (C) no bias
 - (D) both biased equally

1 Mark Questions

1. Name the three terminals of a transistor.
2. How is the emitter of a transistor doped?
3. Define the current gain of a common-emitter amplifier.

2 Mark Questions

1. Explain the working of an n-p-n transistor as an amplifier.
2. Define the current gain and voltage gain of a common-emitter amplifier.

3 Mark Questions

1. Draw the circuit of a common-emitter transistor amplifier and explain how it amplifies a signal, including the phase relationship.
2. Describe the construction of an n-p-n transistor and explain the biasing of its junctions for normal operation.

Logic Gates

MCQ Questions (choose the correct option)

1. The output of an OR gate is high when
 - (A) any input is high
 - (B) all inputs are high
 - (C) all inputs are low
 - (D) inputs are equal
2. The output of an AND gate is high when
 - (A) all inputs are high
 - (B) any input is high
 - (C) all inputs are low
 - (D) inputs differ
3. A NAND gate is
 - (A) an AND gate followed by a NOT gate
 - (B) an OR gate followed by a NOT gate
 - (C) two AND gates
 - (D) two OR gates
4. The output of a NOT gate is
 - (A) the inverse of the input
 - (B) equal to the input
 - (C) always high
 - (D) always low

1 Mark Questions

1. What is a logic gate?
2. Write the truth table of an AND gate.
3. What is the output of a NOR gate when both inputs are zero?

2 Mark Questions

1. Draw the symbols and write the truth tables of the AND, OR and NOT gates.
2. Write the truth tables of the NAND and NOR gates and state why they are called universal gates.

3 Mark Questions

1. Draw the logic symbols and truth tables of the basic gates and explain how NAND and NOR gates are used as universal gates.
2. Explain the working of the OR, AND and NOT gates with truth tables and give one application of logic gates.