Electronics: Principles and Applications, 9e **(Schuler)**
Chapter 2 Semiconductors

1) All materials are made from atoms.

Answer: TRUE
Difficulty: 1 Easy Page Ref: 20
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

2) In the atom, the orbit closest to the nucleus is called the valence orbit.

Answer: FALSE
Difficulty: 1 Easy Page Ref: 20
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

3) The valence electron is important because it acts as a current carrier.

Answer: TRUE
Difficulty: 1 Easy Page Ref: 21
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

4) Aluminum is the most widely applied conductor in electronics.

Answer: FALSE
Explanation: Most wire used in electronics and the foil used in printed circuits are made from copper.
Difficulty: 2 Medium Page Ref: 21
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

5) A material that does not conduct electricity is called an insulator.

Answer: TRUE
Explanation: Some widely used insulators include: rubber, plastic, Mylar, ceramic, Teflon, and polystyrene.
Difficulty: 1 Easy Page Ref: 22
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

6) A mixture is a combination of two or more different kinds of atoms.

Answer: FALSE
Difficulty: 3 Hard Page Ref: 22
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

7) Semiconductors allow current to flow as easily as conductors do.

Answer: FALSE
Difficulty: 1 Easy Page Ref: 23
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

8) Silicon is the most widely used semiconductor material.

Answer: TRUE
Difficulty: 2 Medium Page Ref: 23
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

9) The process of sharing valence electrons is called covalent bonding.

Answer: TRUE
Difficulty: 2 Medium Page Ref: 24
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

10) Impure silicon is sometimes called intrinsic silicon.

Answer: FALSE
Difficulty: 3 Hard Page Ref: 24
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

11) Compounds form the fundamental paths for electronic circuits.

Answer: FALSE
Difficulty: 1 Easy Page Ref: 21
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

12) Pure silicon crystals behave like insulators.

Answer: TRUE
Difficulty: 3 Hard Page Ref: 24
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

13) The semiconductor material silicon has
A) a positive temperature coefficient
B) a negative temperature coefficient
C) three valence electrons
D) one valence electron

Answer: B
Explanation: As temperature increases, resistance decreases in silicon.
Difficulty: 3 Hard Page Ref: 24
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

14) Historically, the first transistors were all made of
A) silicon
B) germanium
C) boron
D) antimony

Answer: B
Explanation: The first silicon transistor was not developed until 1954.
Difficulty: 3 Hard Page Ref: 25
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

15) Integrated circuits are made of
A) silicon
B) germanium
C) boron
D) antimony

Answer: A
Difficulty: 1 Easy Page Ref: 25
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

16) The process of adding other materials called impurities to the silicon crystal to change its electrical characteristics is called
A) bonding
B) ionizing
C) doping
D) crystallizing

Answer: C
Difficulty: 2 Medium Page Ref: 26
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

17) How many valence electrons does arsenic have?
A) 1
B) 3
C) 4
D) 5

Answer: D
Difficulty: 2 Medium Page Ref: 26
Learning Objective: 02-03 Predict the effect of temperature on semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

18) When arsenic is added to a silicon crystal
A) an n-type semiconductor results
B) a p-type semiconductor results
C) a conductor results
D) an insulator results

Answer: A
Difficulty: 2 Medium Page Ref: 26
Learning Objective: 02-03 Predict the effect of temperature on semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

19) In a p-type semiconductor material
A) electrons are the current carriers
B) holes are the current carriers
C) current cannot flow
D) arsenic was the impurity added

Answer: B
Difficulty: 2 Medium Page Ref: 27
Learning Objective: 02-04 Show the directions of electron and hole currents in semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

20) In an n-type semiconductor
A) holes are the majority carriers
B) holes are the minority carriers
C) electrons are the minority carriers
D) there are no carriers

Answer: B
Difficulty: 2 Medium Page Ref: 29
Learning Objective: 02-05 Identify the majority and minority carriers in N-type semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

21) Which of the following is not a compound semiconductor?
A) gallium arsenide
B) silicon dioxide
C) indium phosphide
D) cadmium sulphide

Answer: B
Explanation: Compound semiconductor offers advantages: at very high frequencies, in photonics, and in hostile environments.
Difficulty: 3 Hard Page Ref: 29
Learning Objective: 02-05 Identify the majority and minority carriers in N-type semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

22) Which of the following is not an advantage of organic semiconductors?
A) faster than silicon
B) more flexible than silicon
C) displays are brighter
D) much cheaper

Answer: A
Difficulty: 3 Hard Page Ref: 30
Learning Objective: 02-06 Identify the majority and minority carriers in P-type semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

23) Which of the following is the best conductor of electricity?
A) copper
B) aluminum
C) silver
D) gold

Answer: C
Difficulty: 1 Easy Page Ref: 22
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

24) The process of adding other materials called impurities to the silicon crystal to change its electrical characteristics is
A) bonding
B) mixing
C) doping
D) combining

Answer: C
Difficulty: 1 Easy Page Ref: 26
Learning Objective: 02-03 Predict the effect of temperature on semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

25) Boron is known as what type of impurity?
A) donor
B) acceptor
C) covalent
D) organic

Answer: B
Difficulty: 1 Easy Page Ref: 27
Learning Objective: 02-04 Show the directions of electron and hole currents in semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

26) Which of the following is not a compound semiconductor?
A) Indium phosphide
B) Mercury cadmium telluride
C) Silicon carbide
D) Cadmium arsenide

Answer: D
Difficulty: 3 Hard Page Ref: 29
Learning Objective: 02-05 Identify the majority and minority carriers in N-type semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

27) The energy difference between the top of the valence band and the bottom of the conduction band is called the
A) band gap
B) photon gap
C) wafer gap
D) organic gap

Answer: A
Difficulty: 3 Hard Page Ref: 30
Learning Objective: 02-07 Explain the term band gap.
Bloom's: Remember
Accessibility: Keyboard Navigation

28) All materials are made from _____.

Answer: atoms
Difficulty: 1 Easy Page Ref: 20
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

29) Around the atom's nucleus are orbiting _____ that are negative particles.

Answer: electrons
Explanation: Electrons are negative particles.
Difficulty: 1 Easy Page Ref: 20
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

30) If a conductor becomes hotter, conducts less, and its resistance increases, it has a _____ temperature coefficient.

Answer: positive
Difficulty: 2 Medium Page Ref: 21
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

31) _____ is the most widely applied conductor in electronics.

Answer: Copper
Difficulty: 1 Easy Page Ref: 21
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

32) In a(n) _____ little or no current flows when a voltage is applied.

Answer: insulator
Explanation: In an insulator, the valence electrons are tightly bound to their parent atoms.
Difficulty: 1 Easy Page Ref: 22
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

33) A(n) _____ is a combination of two or more different kinds of atoms.

Answer: compound
Difficulty: 3 Hard Page Ref: 22
Learning Objective: 02-01 Identify some common electronic materials as conductors or semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

34) _____ is the most widely used semiconductor material.

Answer: Silicon
Explanation: Silicon is used to make diodes, transistors, and ICs.
Difficulty: 2 Medium Page Ref: 23
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

35) The process of sharing valence electrons is called _____ bonding.

Answer: covalent
Difficulty: 2 Medium Page Ref: 24
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

36) _____ is the process of adding other materials called impurities to the silicon crystal to change its electrical characteristics.

Answer: Doping
Difficulty: 2 Medium Page Ref: 26
Learning Objective: 02-03 Predict the effect of temperature on semiconductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

37) The material boron has _____ valence electrons.

Answer: three
Explanation: Each boron atom in a crystal will create a hole that is capable of accepting an electron.
Difficulty: 2 Medium Page Ref: 27
Learning Objective: 02-04 Show the directions of electron and hole currents in semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

38) As temperature increases, resistance _____ in silicon.

Answer: decreases
Difficulty: 2 Medium Page Ref: 24
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Understand
Accessibility: Keyboard Navigation

39) _____ started the solid-state revolution in electronics.

Answer: Germanium
Difficulty: 1 Easy Page Ref: 25
Learning Objective: 02-02 Predict the effect of temperature on conductors.
Bloom's: Remember
Accessibility: Keyboard Navigation

40) Minority carriers will be _____ for N-type material.

Answer: holes
Difficulty: 2 Medium Page Ref: 29
Learning Objective: 02-05 Identify the majority and minority carriers in N-type semiconductors.
Bloom's: Remember
Accessibility: Keyboard Navigation