

***** EXAMINATION *****

**PROPERTIES OF WIDE-GAP CHALCOPYRITE SEMICONDUCTORS
FOR PHOTOVOLTAIC APPLICATIONS**

1. **Chalcopyrite is a copper iron sulfide mineral**
 - a) that crystallizes in the hexagonal system
 - b) that crystallizes in the trigonal system
 - c) that crystallizes in the tetragonal system
 - d) that crystallizes in the orthorhombic system

2. **Effusion is the flow of individual molecules in**
 - a) a hole without a collision between molecules
 - b) a hole with a collision between molecules
 - c) a hole without a depletion of molecules
 - d) a hole with a depletion of molecules

3. **Energy dispersive X-ray spectroscopy is an analytical**
 - a) technique used for the elemental analysis of a sample
 - b) technique used for the elemental motion of a sample
 - c) technique used for the elemental direction of a sample
 - d) technique used for the elemental surface of a sample

4. **The Hall effect is the production of a**
 - a) voltage across an electrical conductor
 - b) transverse to an electric current in the conductor
 - c) magnetic field perpendicular to the current
 - d) Any of the above

5. **Gallium arsenide (GaAs) has a higher saturated electron**
 - a) velocity and higher electron scattering
 - b) velocity and higher electron mobility
 - c) velocity and higher electron diffraction
 - d) velocity and higher electron deficiency

6. **Atomic force microscopy is the foremost tools for**
 - a) manipulating matter at the nanomorph
 - b) manipulating matter at the nanopore
 - c) manipulating matter at the nanoscale
 - d) manipulating matter at the nanoprobe

7. **Energy gap is an energy range in a solid**
- a) where no electron states exist
 - b) where no electrider states exist
 - c) where no anyon states exist
 - d) where no lepton states exist
8. **Epitaxy is a method of depositing a monocrystalline**
- a) film on a polycrystalline silicon
 - b) film on a paracrystalline substrate
 - c) film on a monocrystalline silicon
 - d) film on a monocrystalline substrate
9. **Sphalarite is a mineral and the chief**
- a) ore of iron
 - b) ore of zinc
 - c) ore of silicon
 - d) ore of silver
10. **A metal-semiconductor junction that forms a Schottky barrier**
- a) as a device by itself is a Schottky transistor
 - b) as a device by itself is a Schottky sensor
 - c) as a device by itself is a Schottky diode
 - d) as a device by itself is a Schottky capacitor
11. **Band offsets describe the relative alignment of the**
- a) energy bands at a semiconductor heterojunction
 - b) energy bands at a semiconductor homojunction
 - c) energy bands at a semiconductor multijunction
 - d) energy bands at a semiconductor p-n junction
12. **Auger electron spectroscopy is a common analytical**
- a) technique used in the study of directions
 - b) technique used in the study of reactions
 - c) technique used in the study of radiations
 - d) technique used in the study of surfaces
13. **Cathodoluminescence is an optical phenomenon in which**
- a) an electron volt produces the beam of electron
 - b) an electron gun produces the beam of electron
 - c) an electron capturer produces the beam of electron
 - d) an electron engine produces the beam of electron

14. **Photoluminescence is a process where a substance**
- a) absorbs ions and re-radiate ions
 - b) absorbs electrons and re-radiate electrons
 - c) absorbs photons and re-radiate photons
 - d) absorbs and re-radiate gluons
15. **Zinc selenide is an intrinsic semiconductor with a**
- a) band gap of about 2.82 eV at 25 degrees Celsius
 - b) band gap of about 5.82 eV at 25 degrees Celsius
 - c) band gap of about 8.22 eV at 25 degrees Celsius
 - d) band gap of about 8.52 eV at 25 degrees Celsius
16. **Bond length is the average distance between**
- a) nuclei of two bonded atoms in a molecule
 - b) nuclei of three bonded atoms in a molecule
 - c) nuclei of four bonded atoms in a molecule
 - d) nuclei of five bonded atoms in a molecule
17. **Chemical etching is the process of using acids, bases**
- a) or other chemicals to divide unwanted materials
 - b) or other chemicals to dissolve unwanted materials
 - c) or other chemicals to decrease unwanted materials
 - d) or other chemicals to increase unwanted materials
18. **Absolute polarity identification is possible**
- a) by using special chemical etching techniques
 - b) by using special formation techniques
 - c) by using special diffraction techniques
 - d) by using special structuring techniques
19. **Polar orientation can be readily determined by examining**
- a) the etching profiles with an electron microscope
 - b) the etching profiles with a digital microscope
 - c) the etching profiles with a confocal microscope
 - d) the etching profiles with an optical microscope
20. **X-ray diffraction confirms the formation of epitaxial**
- a) layers and a distinct mosaic structure on GaAs
 - b) layers and a distinct mosaic structure on ZnO
 - c) layers and a distinct mosaic structure on CIGS
 - d) layers and a distinct mosaic structure on CdS

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