

<b>Subjective Entrance Examination</b>	
<b>School: Institute of Basic and Applied Sciences</b>	
Duration: <b>1 Hour</b>	Date:
Program Title: <b>Energy Materials (EM)</b>	
No. of Questions: <b>25 (20 MCQ+5 analysis Qs)</b>	Max. Marks: <b>100</b>
Instructor: <b>Prof. Mohsen Ghali</b>	
Allowed Equipment	Calculator, Drawing kit

**Name:**

**ID No.**

**Instructions to Students**

Mobile phones are Not allowed during the exam

- You should attempt all questions
- Assume any missing data
- Number of questions 25
- The exam papers are in 7 pages including this page
- Select the right answer of the multiple choice questions and mark it in the answer sheet (page 5). Rest of questions should be answered in the place assigned for that.

**Choose the correct answer and fill in the given table by the letter (s) preceding the correct answer:**

- Q1. The crystallite size of nanocrystals powder can be determined using:
- |                                 |                                     |
|---------------------------------|-------------------------------------|
| a. Scanning Electron Microscope | b. Transmission Electron Microscope |
| c. Optical Microscope           | d. Naked eye                        |
- Q2. The band gap ( $E_g$ ) of material is strongly dependent on:
- |                            |                     |
|----------------------------|---------------------|
| a. Crystallite size        | b. Materials doping |
| c. Internal electric field | d. All of them      |
- Q3. The electrical resistivity of a semiconductor material relies very strongly on :
- |                |                         |
|----------------|-------------------------|
| a. Dimensions  | b. Researcher character |
| c. Environment | d. Doping level         |
- Q4. "Hole" spin represents a permanent magnet with magnetic moment equals:
- |              |              |
|--------------|--------------|
| a. $\pm 1/2$ | b. $\pm 3/2$ |
| b. $-1/2$    | d. $+3/2$    |
- Q5. In semiconductors, the ratio between the mass of "hole" to the mass of "electron" ( $m_h/m_e$ ) is:
- |             |            |
|-------------|------------|
| a. $> 1$    | b. $\pm 1$ |
| c. $\geq 1$ | d. $< 1$   |
- Q6. When photon is transmitted through a semiconductor, this means that the semiconductor band gap ( $E_g$ ) is:
- |  |  |
|--|--|
| a. Greater than the incident photon energy | b. Equal to the incident photon wavelength |
| c. Smaller than the incident photon energy | d. infinity                                |
- Q7. The measured sheet resistance of thin film material is independent on:
- |                              |                       |
|------------------------------|-----------------------|
| a. Material dimensions       | b. Material thickness |
| c. Material surface geometry | d. All of them        |

Q8. Magnetic materials lose their magnetization mainly by :

- a. Heating
- b. Cooling
- c. Electric field
- d. Magnetic field

Q9. Examples of Optoelectronic devices are:

- a. Milling machine
- b. Solar Cells
- c. Light Emitting Diodes
- d. Transistors

Q10. The crystal structure of liquid can not be measured by:

- a. Any tools
- b. X-ray diffraction
- c. Transmission Electron Microscopy
- d. Electrical measurements

Q11. The crystal structure of single crystals can be measured by :

- a. No tools
- b. X-ray diffraction
- c. Transmission Electron Microscopy
- d. Electrical measurements

Q12. The “current source” device is usually used for:

- a. Low-resistance measurement
- b. Constant current supply
- c. High-resistance measurement
- d. Optical polarization anisotropy

Q13. Refractive index of thin and thick films can be calculated using:

- a. UV-Vis-NIR Spectrophotometer
- b. Spectrofluorometer
- c. Atomic Force Microscope
- d. Electron Spin Resonance

Q14. Quantum mechanics should be applied for materials size close to :

- a. DeBroglie wavelength
- b. UV light wavelength
- c. Visible light wavelength
- d. IR wavelength

Q15. The carriers type in metals can be determined using:

- a. Four-probe station
- b. Scanning Electron Microscopy
- c. Hall-effect
- d. Ellipsometry

Q16. The output maximum power of solar cell device can be quantified from:

- a. Current-Voltage measurements
- b. Voltage-Voltage measurements
- c. Capacitance-Voltage measurements
- d. None of these

Q17. Transmission Electron Microscope technique is used for :

- a. Crystallographic structure determination
- b. Crystallite size determination
- c. Crystal symmetry determination
- d. All of these

Q18. Colloidal Quantum dots are typically prepared using:


- a. Sputtering
- b. Thermal evaporation
- c. Wet chemistry
- d. All of these

Q19. In Solar cells devices, it is essential to:

- a. Separate photo-created electrons and holes
- b. Remove photo-created electrons and holes
- c. None of these
- d. Recombine photo-created carriers

Q20. The White light emitted from Light emitting diodes includes:

- a. Red, Green, Blue colors
- b. Red and Green colors only
- c. Red and blue colors only
- d. Blue and Green colors only

 <p>الجامعة المصرية اليابانية للعلوم والتكنولوجيا E-JUST Egypt - Japan University of Science and Technology エジプト日本科学技術大学</p>	<p><b>Subjective</b> <b>Entrance Examination</b></p>
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(Answer sheet)

Question No.	Answer	Question No.	Answer
1		14	
2		15	
3		16	
4		17	
5		18	
6		19	
7		20	
8			
9			
10			
11			
12			
13			



Correct the following sentences:

4. Electron and Positron cannot form an electric dipole.

5. Discuss shortly the importance of Maxwell's equations in Materials science.

\*\*\*\*\* End of Questions \*\*\*\*\*