



# Sanjay Ghodawat University, Kolhapur

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

2018-19

EXM/P/09/00

M.Sc. II

School of Science

Department of Physics

PHN 604

Properties of Nanomaterials

Semester – IV

Day & Date *Thursday*  
*23<sup>rd</sup> May, 2019*

End Semester Examination  
*(A)*

Time: 30 Minutes Max Marks: 20  
*(2.30 to 3.00 pm)*

|                   |                |                 |
|-------------------|----------------|-----------------|
| Seat No.:         | PRN No.:       | Student Sign:   |
| Invigilator Sign: | Examiner Sign: | Marks Obtained: |

## Instructions:

- 1) All Questions are compulsory.
- 2) Mark  $\sqrt{\quad}$  to the correct option. Do not circle.
- 3) More than one options marked will not be considered for assessment.
- 4) Rough calculations on paper are not allowed
- 5) Use non-programmable calculator is allowed.

## Q.1 Select correct alternatives

Marks Bloom's CO  
Level

1. The surface energy can be given by the formula, where, A is surface area and G is Gibbs free energy. 01 L1 604.1

a)  $\gamma = \left(\frac{\partial A}{\partial G}\right)_{n_i, T, P}$  b)  $\gamma = \left(\frac{\partial G}{\partial A}\right)_{n_i, T, P}$   
c)  $\gamma = \left(-\frac{\partial A}{\partial G}\right)_{n_i, T, P}$  d)  $\gamma = \left(-\frac{\partial G}{\partial A}\right)_{n_i, T, P}$

2. The surface energy can be given by the formula, where,  $N_b$  is number of broken bonds,  $\epsilon$  is bond strength and  $\rho_a$  is surface atomic density. 01 L1 604.1

a)  $\gamma = \frac{1}{3} N_b \epsilon \rho_a$  b)  $\gamma = \frac{1}{2} N_b \epsilon \rho_a$   
c)  $\gamma = -\frac{1}{3} N_b \epsilon \rho_a$  d)  $\gamma = -\frac{1}{2} N_b \epsilon \rho_a$

**ESE**

- |     |                                                                                                                                  |    |                           |       |
|-----|----------------------------------------------------------------------------------------------------------------------------------|----|---------------------------|-------|
| 3.  | Each atom in a FCC crystal has a coordination number of ,                                                                        | 01 | L2                        | 604.1 |
| a)  | 6                                                                                                                                | b) | 8                         |       |
| c)  | 12                                                                                                                               | d) | 14                        |       |
|     |                                                                                                                                  |    |                           |       |
| 4.  | The process of reduction of surface energy in which relatively large structures grow at the expense of smaller ones is known as, | 01 | L2                        | 604.1 |
| a)  | Sintering                                                                                                                        | b) | Ostwald ripening          |       |
| c)  | Agglomeration                                                                                                                    | d) | None of the above         |       |
|     |                                                                                                                                  |    |                           |       |
| 5.  | According to thermodynamics any material or system is stable only when it is in a state with the _____ Gibbs free energy.        | 01 | L2                        | 604.1 |
| a)  | highest                                                                                                                          | b) | lowest                    |       |
| c)  | constant                                                                                                                         | d) | none of the above         |       |
|     |                                                                                                                                  |    |                           |       |
| 6.  | Surface energy of {100} faces in diamond and silicon crystals before restructuring is _____ of both {111} and {110} faces.       | 01 | L1                        | 604.1 |
| a)  | higher than                                                                                                                      | b) | lower than                |       |
| c)  | same as                                                                                                                          |    |                           |       |
|     |                                                                                                                                  |    |                           |       |
| 7.  | In the process of doping, when Si replaces Ga of the GaAs, it resulted in _____ semiconductor                                    | 01 | L2                        | 604.2 |
| a)  | n-type                                                                                                                           | b) | p-type                    |       |
|     |                                                                                                                                  |    |                           |       |
| 8.  | In silicon intrinsic carrier concentration $n_i$ is about _____.                                                                 | 01 | L1                        | 604.2 |
| a)  | $10^8 \text{ cm}^{-3}$                                                                                                           | b) | $10^9 \text{ cm}^{-3}$    |       |
| c)  | $10^{10} \text{ cm}^{-3}$                                                                                                        | d) | $10^{11} \text{ cm}^{-3}$ |       |
|     |                                                                                                                                  |    |                           |       |
| 9.  | The band gap energy of AlAs is, _____ eV                                                                                         | 01 | L1                        | 604.2 |
| a)  | 1.14                                                                                                                             | b) | 1.43                      |       |
| c)  | 2.16                                                                                                                             | d) | 3.10                      |       |
|     |                                                                                                                                  |    |                           |       |
| 10. | The ternary alloy AlGaAs is a direct semiconductor for Al compositions up to about _____ %.                                      | 01 | L1                        | 604.2 |
| a)  | 25                                                                                                                               | b) | 35                        |       |
| c)  | 28                                                                                                                               | d) | 38                        |       |

**ESE**

11. Surface Plasmon Energies depends on shape of the metal nanoparticle. 01 L1 604.3  
 a) True b) False
12. The Excitonic Bohr Radius of CdSe is around \_\_\_\_ nm 01 L1 604.3  
 a) 5 b) 6  
 c) 7 d) 8
13. If the excited carriers are created in luminescent material by high energy electron bombardment, the mechanism is called \_\_\_\_\_. 01 L1 604.3  
 a) Photoluminescence b) Cathodoluminescence  
 c) Electroluminescence d) Chemiluminescence
14. In the process of indirect recombination, if the most probable next event is capture of the opposite type of carrier then the center is predominately a \_\_\_\_\_ center. 01 L2 604.3  
 a) Trapping b) Recombination  
 c) None of the above
15. Hard magnets have \_\_\_\_\_ coercivity 01 L2 604.4  
 a) Low b) High  
 c) Zero d) No relation
16. The \_\_\_\_\_ is a quantum mechanical effect that causes aligned magnetic moments to be energetically favorable. 01 L2 604.4  
 a) exchange interaction b) magnetocrystalline anisotropy  
 c) external magnetic field d) None of the above
17. There is an energy \_\_\_\_\_ when the magnetic moments are anti-parallel and an energy \_\_\_\_\_ when the magnetic moments are parallel. 01 L2 604.4  
 a) Maximum, Minimum b) Minimum, Maximum  
 c) No relation

**ESE**

18. \_\_\_\_\_ refers to a crystal's property to be more easily magnetized in some directions in comparison to others. 01 L1 604.4
- a) Exchange interaction      b) Magnetocrystalline anisotropy  
c) External magnetic field      d) None of the above
19. A thin domain wall represents a \_\_\_\_\_ change in magnetic moment whereas a thick domain wall represents a \_\_\_\_\_ change in magnetic moment. 01 L2 604.4
- a) very quick, slow      b) slow, very quick
20. The point in which there is no longer a magnetic flux ( $B=0$ ) due to the cancelation of dipole moments acting in opposite directions is known as the \_\_\_\_\_. 01 L2 604.4
- a) coercivity point      b) retentivity point  
c) saturation point      d) None of the above

**ESE**

**Sanjay Ghodawat University, Kolhapur**

Established as State Private University under Govt. of Maharashtra. Act No XL, 2017

2018-19  
EXM/P/09/00

M.Sc. II

School of Science

Department of Physics

PHN604

Properties of Nanomaterials

Semester – IV

Day & Date *Thursday*  
*23<sup>rd</sup> May, 2019*

End Semester Examination

Time: 2 Hours 30 Minutes

Max Marks: 80

(3 to 5.30 PM)

(B)

**Instructions:**

- 1) All Questions are compulsory
- 2) Rough calculations on paper are not allowed
- 3) Use of non-programmable calculator is allowed.

**Q.2. Attempt the following****Marks****Bloom's  
Level****CO**

- |                                                                                                                    |    |    |       |
|--------------------------------------------------------------------------------------------------------------------|----|----|-------|
| 1. Discuss the formation of energy band gap with the help of hypothetical Si crystal made up of N number of atoms. | 12 | L4 | 604.2 |
| 2. Explain in brief the variation of band gap energy with respect to alloy composition.                            | 4  | L2 | 604.2 |
| <b>Or</b>                                                                                                          |    |    |       |
| 2. Write a brief note on effective mass of the charge carriers in semiconductors.                                  | 4  | L2 | 604.2 |

**Q.3. Attempt the following****Marks****CO**

- |                                                                            |    |    |       |
|----------------------------------------------------------------------------|----|----|-------|
| 1. Discuss in detail the indirect recombination process in semiconductors. | 12 | L2 | 604.3 |
| 2. Elaborate the concept of Exciton.                                       | 4  | L2 | 604.3 |
| <b>Or</b>                                                                  |    |    |       |
| 2. Write a brief note on Localized Surface Plasmon Resonance (LSPR)        | 4  | L2 | 604.3 |

**ESE**