KATHMANDU UNIVERSITY
End Semester Examination
March/April 2017

Marks Scored:

Level : B.Sc.
Year : IV
Course : PHYS 403
Semester: I

Exam. Roll No. :
Time: 30 mins.
F.M. : 20

Registration No.:
Date :

SECTION "A"
[20 Q. × 1= 20 marks]

Choose and tick the most appropriate answer.

1. Dislocation in a crystal is _____ defect.
[a] 1D [b] bulk [c] planer [d] shear

2. ..... in monoatomic metals most commonly proceeds by lattice vacancies.
[a] self-diffusion [b] dispersion [c] conductivity [d] transparency

3. Plastic deformations in a crystal are
[a] reversible [b] irreversible [c] weak [d] very weak

4. If atom is transferred from lattice to an interstitial position the defect is called
[a] Frankel defect [b] Berger's vector [c] screw dislocation [d] slip

5. Bond length between C-C atoms in SWNT is about
[a] 1.42Å [b] 2.6Å [c] 3.0Å [d] 1.1Å

6. Which of the following is NOT from surface defect?
[a] grain boundaries [b] twins [c] stacking faults [d] substitutional

7. Optical lithography is mostly used in producing
[a] coin [b] integrated circuit
[c] multilayered film [d] carbon nanotube

8. In the fixed force AFM the changes occurs on the _____.
[a] distance between tip and sample [b] potential between tip and sample
[c] electric field between tip and sample [d] force between tip and sample

9. The distance between two successive [110] planes in sc crystal is _____.
[a] a/2 [b] $a/\sqrt{2}$ [c] $a/\sqrt{3}$ [d] a/3

10. What is the surface area of a cube of volume $1cm^3$ is divided into a cubes of volume $1nm^3$?
[a] $6.0 \times 10^9\ cm^2$ [b] $6.0 \times 10^{10}\ cm^2$
[c] $6.0 \times 10^7\ cm^2$ [d] $6.0 \times 10^{18}\ cm^2$

Fill in the blanks with appropriate word(s).

11. The finite crystals on all three dimensional space of a material is generally called _____.

12. For indirect band gap semiconductors the minimum of conduction band and maximum of valance band lie _____ k-point.

13. The single-walled nanotube is well described by its _____, (n, m) that specify the perimeter of the tube on the surface net.

14. The _____ of direct lattice with reciprocal lattice is always unity.

15. In diffusion the quantity involved moves from _____ to _____ concentration.

16. Scanning tunneling microscope is made in the principle of _____ mechanical tunneling, where particle with lower energy can overcome the barrier of higher energy with certain _____.

17. The perpendicular distance between the two planes indicated by the Miller indices [1 2 1] and [2 1 2] in a unit cell of a cubic lattice is about _____ *a*.

18. _____ of Bragg's peak depends on the _____ of scattered beams.

19. The optical or many physical properties of quantum dots depends on _____ size.

20. Preimaged _____ is very helpful in _____ projected optical lithography for mass production of fabrication items.

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APR 0 3 2017

Level : B.Sc.
Year : IV
Time : 2 hrs. 30 mins.

Course : PHYS 403
Semester: I
F.M. : 55

SECTION "B"
[5 Q. × 4= 20 marks]

1. Write some markedly different properties of nanomaterials in comparison to their bulk.

2. Describe voids or vacancy found in Alkali halides.

OR

Classify the nano-structured materials and discuss its future perspectives.

3. Explain the term alloy with some examples and properties. Describe how they differ from their end products.

4. What do you mean by Quantum dots? Write a short note on its possible applications.

5. How is x-ray diffraction method used to characterize the nanomaterials?

SECTION "C"
[5 Q. × 7= 35 marks]

6. Describe two top-buttom growth techniques with suitable examples.

OR

Calculate the distances between two consecutive planes [2 1 2] of a simple cubic crystal with lattice constant 3.18 Å.

7. Calculate the axial-periodicity of single walled carbon nanotube.

8. Describe the principle, working and application of AFM with the help of a well labeled diagram.

9. Derive the formula for atomic form factor of bcc lattice.

10. Differentiate between lithographic and non-lithographic processes. Describe the working principle of molecular beam epitaxy method.

OR

Using Vagard's law calculate the equilibrium lattice constants of an alloy made of elements A and B for the concentrations of 12.5% and 25% of B.
Given $a_A = 4.5$Å, $a_B = 5.3$Å, $c_A = 6.3$Å and $c_B = 7.1$Å