STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-2012)

SUBJECT CODE : 11PH/MC/SS54

B.Sc. DEGREE EXAMINATION NOVEMBER 2013
BRANCH III - PHYSICS
FIFTH SEMESTER

REG. No._____

COURSE : MAJOR – CORE
PAPER : SOLID STATE PHYSICS
TIME : 30 MINS. **MAX. MARKS : 30**

SECTION – A
TO BE ANSWERED IN THE QUESTION PAPER ITSELF
ANSWER ALL THE QUESTIONS: **(30 × 1 = 30)**

I CHOOSE THE RIGHT OPTION:

1. The strongest bond is _____.
   a) Covalent bond b) Ionic bond
   c) Vander Waals bond d) Metallic bond

2. The length of H – H bond is (in nm) _____.
   a) 0.074 b) 0.01
   c) 0.037 d) 2

3. What is the nature of binding in CH_4 _____
   a) Metallic b) Covalent
   c) Ionic d) dispersion

4. Which of the following relation gives Wiedemann-Franz law:_____.
   a) $\sigma_\tau/\sigma_e = LT$ b) $\sigma_e/\sigma_\tau = LT$
   c) $\sigma_\tau/\sigma_e = L/$ d) $\sigma_\tau/\sigma_e = T/L$

5. The temperature dependence of the classical expression for electrical resistivity of metal is _____.
   a) $\rho \infty T^2$ b) $\rho \infty 1/T^2$
   c) $\rho \infty 1/T$ d) $\rho \infty 1/\sqrt{T^2}$

6. Ohms law relates to the electric field E, conductivity σ and current density J as _____.
   a) $J = \sigma E$ b) $J = \sigma E^2$
   c) $J = E/\sigma$ d) $J = \sigma/E$

7. A lattice vacancy is often indicated in illustration chemical equations by a _____.
   a) Point b) Circle
   c) Square d) Rectangle

...2

8. When an atom leaves its site and dissolves interstitially into the structure it is called _____.
   a) Schottky defect b) Frenkel defect
   c) Vacancy pair d) Grain defect

9. Boundary between two parts of a closest packing having alternate staking sequence is called _____.
   a) Grain defect b) Staking fault
   c) Screw dislocation d) Lineage boundary

10. Dimensions of magnetic susceptibility are
   a) Wb/m b) Wb/m^2
   c) dimensionless d) amp-m

11. The most important characteristics of ferromagnetic materials is _____.
   a) Spontaneous magnetization b) Neel temperature
   c) Faraday's temperature d) demagentization temperature

12. Domain structure are shown by solids exhibiting _____.
   a) Antiferromagnetism b) ferroelectric properties
   c) superconductivity d) all the above

13. Type II (hard) superconductor observe _____.
   a) Partial Meissner-Ochsenfield effect
   b) Breakdown of Silsbee effect
   c) High critical field (H_c) and high temperature
   d) All of the above

14. For a material to be considered as superconductor, it has to exhibit
   a) Only Zero resistivity
   b) Only Meissner effect
   c) both Zero resistivity and Meissner effect
   d) Only Josephson effect

15. Between H_{c1} and H_{c2} , flux enters into Type II superconductor and forms a triangular lattice of flux lines. This is called _____ .
   a) Meissner effect b) Vortex lattice
   c) Josephson effect d) Reentrant superconducitvity

II. FILL IN THE BLANKS:

16. Vander Waals interaction varies with interatomic separation as r^n where n is _____.

17. The thermal conductivity of metals is given by the expression _____.

18. Small and tightly bound excition is called _____.

19. Ferrits have found increasing number of application because in many cases they yield higher _____, small volume, lower costs, greater uniformity and ease of manufacture.

20. The London penetration depth is _____.

III. STATE WHETHER TRUE OR FLASE:

21. The binding of a crystal with alternate and evenly spaced positive negative ion is dipole.

22. If E, J and B are the Hall field, current density and magnetic field strength, then Hall constant is given by $R_H = EJ/B$.

23. An atom displaced to interstitial site creating nearby vacancy is called Frenkel defect.

24. Above Curie temperature the ferromagnetic materials become diamagnetic.

25. The temperature at which a metal becomes a superconductor is called Neel temperature.

IV. ANSWER BRIEFLY

26. Distinguish between metallic bonds and covalent bonds?

27. What is Schottky defect?

28. What is the value of Lorentz number L?

29. Why diamagnetic susceptibility is negative?

30. What is Cooper pair?

****

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-2012)
SUBJECT CODE : 11PH/MC/SS54

B.Sc. DEGREE EXAMINATION NOVEMBER 2013
BRANCH III - PHYSICS
FIFTH SEMESTER

COURSE : MAJOR – CORE
PAPER : SOLID STATE PHYSICS
TIME : 2 HOURS 30 MINS. MAX. MARKS : 70

SECTION - B

ANSWER ANY FIVE QUESTIONS: (5 × 5 = 25)

1. Calculate the Madelung constant for a three dimensional crystal of NaCl.

2. In alkali metal is introduced into alkali halide crystals at high temperature and not properly quenched, the alkali metal will precipitate out as colloidal particle. How would the properties of these particles differ from F centres?

3. What are the failures of the Drude-Lorentz free electron theory?

4. Explain the cause of hysteresis phenomenon in ferromagnetic materials? What does the area of the loop signify?

5. Explain the difference between the terms 'Curie temperature' and 'Neel temperature'.

6. How does the energy gap in superconductors differ from the energy gap in insulators? How does it vary with temperature for superconductors?

7. Write a brief note on potential applications of superconductors.

SECTION – C

ANSWER ANY THREE QUESTIONS: (3 × 15 = 45)

8. Describe the nature and origin of various forces existing between the atoms of a crystal. Explain the formation of a stable bond using the potential energy versus interatomic distance curve.

9. What are Schottky and Frenkel defect? How does the equilibrium concentration of vacancies decrease with temperature? Deduce necessary relation to explain it.

10. On the basis of the free electron theory derive an expression for the electrical and thermal conductivity of metal and hence establish Wiedemann Franz law.

11. Derive the Langevin's theory of paramagnetism and obtain an expression for paramagnetic susceptibility. Comment on the temperature dependence of susceptibility.

12. Explain the difference between type I and II superconductors using the Meissner effect. Prove that the Meissner effect and the disappearance of resistivity in a superconductor are mutually consistent.

****