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Courses » Introduction to Solid State Physics Announcements **Course** Ask a Question Progress FAQ

## Unit 12 - Magnetism in materials

Register for  
Certification exam

### Course outline

How to access the  
portal

Introduction to  
Drude's free  
electron theory of  
metals, electrical  
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Vibrations of  
Crystals with  
Monatomic Basis,  
Acoustic modes

Two Atoms per

### Assignment 11

The due date for submitting this assignment has passed.  
As per our records you have not submitted this assignment.

**Due on 2019-04-17, 23:59 IST**

1) The ion  $\text{Dy}^{3+}$  of rare earth element dysprosium has nine 4f electrons. The L, S and the J values for the ion are, respectively 1 point

- 5, 5/2 and 5/2
- 5, 5/2 and 15/2
- 3, 9/2 and 3/2
- 3, 9/2 and 15/2

No, the answer is incorrect.

Score: 0

Accepted Answers:  
5, 5/2 and 15/2

2) Magnetic susceptibility of one gram mole of  $\text{Dy}^{3+}$  at 20K is close to 1 point

- $1.06 \times 10^{-5}$
- $1.38 \times 10^{-6}$
- $8.87 \times 10^{-6}$
- $4.43 \times 10^{-5}$

No, the answer is incorrect.

Score: 0

Accepted Answers:  
 $8.87 \times 10^{-6}$

3) The ion  $\text{Cu}^{2+}$  belongs to the iron group ions. It has nine 3d electrons. If the magnetic moment of copper ion in a salt is  $p\mu_B$  then theoretically calculated value of p is 1 point

- 1.73
- 3.55
- 2.14
- 2.85

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for wavefunction of a particle in a periodic potential, nearly free electron model, origin of energy band gaps, discussion of Bloch wavefunction

Band theory of metals, insulators and semiconductors, Kronig-Penney model, tight binding method of calculating bands, and semi-classical dynamics of a particle in a band

Introductory Semiconductor Physics

Magnetism in materials

- Paramagnetism in solids I - Magnetic moment and Lande g factor for atoms
- Paramagnetism in solids II - temperature dependence of paramagnetic susceptibility and Curie's Law
- Hund's rule for calculating the total angular momentum J, orbital angular momentum L and spin angular momentum S for an atom
- Examples of performing paramagnetic susceptibility calculations
- Diamagnetism in Solids
- Understanding quenching of orbital angular momentum in transition metal ions
- Ferromagnetism in solids
- Quiz : Assignment 11
- Introduction to Solid State Physics :

the lowest energy state at temperature 1K is about

- 0.9 T
- 1.2 T
- 2.6 T
- 3.4 T

No, the answer is incorrect.

Score: 0

Accepted Answers:

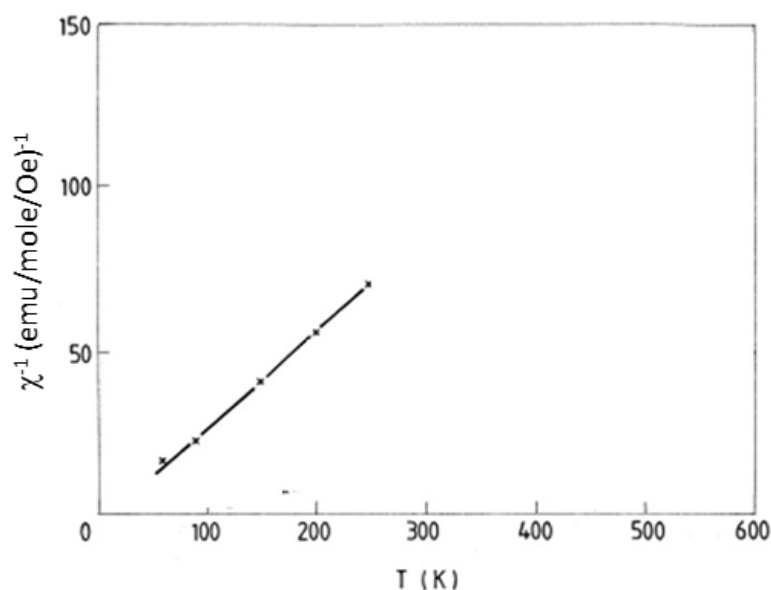
3.4 T

5)

Calculate the effective Bohr magneton number from the graph shown below (use:

$$N_A = 6.023 \times 10^{23} \text{ /mole}, \mu_0 = 4\pi \times 10^{-7} \text{ N/A}^2, \mu_B = 9.2 \times 10^{-21} \text{ erg/G}, k_B = 1.2 \times 10^{-23}$$

$$\text{J.K}^{-1}, 1 \text{ emu.cc}^{-3} = 4\pi \text{ G}, 1 \text{ A.m}^2 = 10^3 \text{ erg/G}$$



- 0.1m<sub>B</sub>
- 5m<sub>B</sub>
- 10m<sub>B</sub>
- 1m<sub>B</sub>

No, the answer is incorrect.

Score: 0

Accepted Answers:

5m<sub>B</sub>

6) Magnetic ions with  $S = 5/2$  and  $L = 0$  are spaced 0.5nm apart. Temperature T below which they will have a high probability of alignment is

Feedback For  
Week 11

Assignment 11  
Solution

Superconductivity

Solutions of  
Assignments

- 0.12 K
- 0.58 K
- 1.2 K
- 4.2 K

No, the answer is incorrect.

Score: 0

Accepted Answers:

0.12 K

7)

Define the exchange field in a ferromagnet as  $\vec{B}_E = \lambda \vec{M}$  where  $\vec{M}$  is the magnetization per mole. Value of  $\vec{B}_E$  for iron which has a Curie temperature of 1043 K and an effective magnetic moment of  $2.2\mu_B$  is close to

- 10000 T
- 7400 T
- 4700 T
- 2100 T

No, the answer is incorrect.

Score: 0

Accepted Answers:

2100 T

8) The ferromagnet europium oxide has a Curie temperature of 70 K. The europium ion has  $J = 7/2$  and  $g = 2$ . Assuming mean field theory to be correct, the ratio of magnetization at 300 K in a field of  $10^{-2}$  T to that at 0K will be close to

- $7.7 \times 10^{-5}$
- $5.1 \times 10^{-5}$
- $7.7 \times 10^{-6}$
- $7.7 \times 10^{-4}$

No, the answer is incorrect.

Score: 0

Accepted Answers:

$7.7 \times 10^{-5}$

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