

Course outline

How does an NPTEL online course work?

Week 1

Week 2

Week 3

Week 4

Week 5

Week 6

Week 7

 Introduction to diamagnetism

 Issues with the classical theory of diamagnetism

 Quantum theory of diamagnetism

 The quantum theory of paramagnetism

 Rare earth atoms, Hund's rule

 Crystal field splitting

 Quenching of orbital angular momentum

 Paramagnetic susceptibility of conduction electrons

 Ferromagnetism

 Week 7 Feedback Form: Solid State Physics

 Quiz: Week 7: Assignment 7

Week 8

DOWNLOAD VIDEOS

Lecture notes

Solutions

Week 7: Assignment 7

The due date for submitting this assignment has passed.

Due on 2021-10-13, 23:59 IST.

As per our records you have not submitted this assignment.

The wave function of the hydrogen atom in its ground state (1s) is $\psi = (\pi a_0^3)^{-\frac{1}{2}} \exp(-\frac{r}{a_0})$ where $a_0 = 0.529 \times 10^{-8}$ cm. The charge density is $\rho(x, y, z) = -e|\psi|^2$, according to the statistical interpretation of the wave function.

 1) Then the value of $\langle r \rangle$ is given by

0 points

- $5a_0^2$
 $2a_0^2$
 $4a_0^2$
 $3a_0^2$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $3a_0^2$

2) The molar diamagnetic susceptibility of atomic hydrogen is

2 points

- $-2.3 \times 10^{-6} \text{ cm}^3/\text{mole}$
 $-4.6 \times 10^{-6} \text{ cm}^3/\text{mole}$
 $2.3 \times 10^{-6} \text{ cm}^3/\text{mole}$
 $4.6 \times 10^{-6} \text{ cm}^3/\text{mole}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $-2.3 \times 10^{-6} \text{ cm}^3/\text{mole}$

 3) By applying Hund's rule, the ground state of Yb^{+3} and Tb^{+3} is:

2 points

- $^2F_{7/2}$ and 7F_6
 $^2F_{5/2}$ and $^7F_{5/2}$
 2F_6 and 7F_6
 $^2F_{7/2}$ and $^7F_{3/2}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $^2F_{7/2}$ and 7F_6

The magnetization within a bar of some metal alloy is 1.2×10^6 A/m when the H field is 200 A/m.

 4) The magnetic susceptibility χ_m of this alloy is,

2 points

- 4000
 4560
 5400
 6000

No, the answer is incorrect.
Score: 0

Accepted Answers:
6000

 5) The permeability μ' can be estimated to be:

2 points

- $5.82 \times 10^{-4} \text{ H/m}$
 $7.54 \times 10^{-3} \text{ H/m}$
 $6.72 \times 10^{-4} \text{ H/m}$
 $3.64 \times 10^{-3} \text{ H/m}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
 $7.54 \times 10^{-3} \text{ H/m}$

6) Calculate the number of Bohr magnetons per atom of iron, given that the saturation magnetization $M_s = 1.70 \times 10^6$ A/m, that iron has a BCC crystal structure, and that the edge length of the cubic unit cell is 0.287 nm.

2 points

- 3.60
 2.16
 3.48
 2.84

No, the answer is incorrect.
Score: 0

Accepted Answers:
2.16