

Unit 11 - Week 9

Course outline

How does an NPTEL online course work?

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Week 9

● Lecture 39 : Zeeman Effect

● Lecture 40 : Zeeman Effect (Contd.)

○ Lecture 41 : Zeeman Effect (Contd.)

○ Lecture 42 : Sodium Yellow Doublet

● Lecture 43 : Sodium Yellow Doublet (Contd.)

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DOWNLOAD VIDEOS

Assignment Detailed Solution

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Assignment 9

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

Due on 2020-04-01, 23:59 IST.

1) Determine the normal Zeeman splitting of the cadmium red line of 6438 \AA when the atoms are placed in a magnetic field of 0.01 T . [Given: Bohr magneton, $\mu_B = \frac{e\hbar}{2m} = 5.79 \times 10^{-5} eV/T$ and Planck constant, $\hbar = 4.14 \times 10^{-15} eV - s$]

- (a) $1.12 \times 10^{-5} \text{ \AA}$
 (b) $1.74 \times 10^{-4} \text{ \AA}$
 (c) $1.93 \times 10^{-3} \text{ \AA}$
 (d) $2.12 \times 10^{-2} \text{ \AA}$

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(c)

2) What magnetic flux density B is required to observe the normal Zeeman Effect if a spectrometer can resolve spectral lines separated by 0.5 \AA at 6000 \AA . [Given: Bohr magneton, $\mu_B = \frac{e\hbar}{2m} = 5.79 \times 10^{-5} eV/T$ and Planck constant, $\hbar = 4.14 \times 10^{-15} eV - s$]

- (a) 1.28 T
 (b) 2.98 T
 (c) 3.18 T
 (d) 4.58 T

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(b)

3) In a normal Zeeman experiment the calcium 4226 \AA line splits into three lines separated by 0.25 \AA in a magnetic field of 3 T . Determine e/m for the electron from these data.

- (a) $1.23 \times 10^7 \text{ C/kg}$
 (b) $2.46 \times 10^9 \text{ C/kg}$
 (c) $3.33 \times 10^{10} \text{ C/kg}$
 (d) $1.76 \times 10^{11} \text{ C/kg}$

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(d)

4) Transitions occur in an atom between $l = 2$ and $l = 1$ states in a magnetic field of 0.6 T . If the wavelength before the field was turned on was 5000 \AA , determine the wavelengths that are observed. [Given: Bohr magneton, $\mu_B = \frac{e\hbar}{2m} = 5.79 \times 10^{-5} eV/T$ and Planck constant, $\hbar = 4.14 \times 10^{-15} eV - s$]

- (a) $5000.29 \text{ \AA}, 4999 \text{ \AA}, 5000.73 \text{ \AA}$
 (b) $5000.07 \text{ \AA}, 5000 \text{ \AA}, 4999.93 \text{ \AA}$
 (c) $2999.63 \text{ \AA}, 4894 \text{ \AA}, 3999.73 \text{ \AA}$
 (d) $5000.83 \text{ \AA}, 4998 \text{ \AA}, 4998.01 \text{ \AA}$

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(b)

5) What is the frequency difference in the photons emitted in a normal Zeeman Effect corresponding to transitions from adjacent magnetic sublevels to the same final state in a magnetic field of 1.2 T ? [Given: Bohr magneton, $\mu_B = \frac{e\hbar}{2m} = 5.79 \times 10^{-5} eV/T$ and Planck constant, $\hbar = 4.14 \times 10^{-15} eV - s$]

- (a) $2.12 \times 10^{15} \text{ Hz}$
 (b) $4.33 \times 10^{13} \text{ Hz}$
 (c) $5.12 \times 10^{18} \text{ Hz}$
 (d) $1.68 \times 10^{10} \text{ Hz}$

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(d)

6) A grating (with 20000 lines per inch) is illuminated by sodium light. The grating spectrum is observed on the focal plane of a convex lens of focal length 10 cm . Calculate the separation between D_1 and D_2 lines of sodium light for the first order spectrum. (The wavelength of D_1 and D_2 lines are 5890 \AA and 5896 \AA respectively).

- (a) $5.233 \times 10^{-3} \text{ cm}$
 (b) $7.923 \times 10^{-3} \text{ cm}$
 (c) $6.142 \times 10^{-4} \text{ cm}$
 (d) $3.129 \times 10^{-5} \text{ cm}$

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(a)

7) An element is placed in magnetic field of 0.5 T . Calculate the Zeeman shift of a spectral line of wavelength 500 nm .

- (a) 0.25 nm
 (b) 0.75 nm
 (c) 0.028 nm
 (d) 0.59 nm

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(d)

8) The Zeeman components of a spectral line of 550 nm are 0.012 nm apart when the magnetic field is 1.2 T . Find the ratio of e/m using above information.

- (a) $1.75 \times 10^{11} \text{ C/Kg}$
 (b) $1.254 \times 10^{11} \text{ C/Kg}$
 (c) $1.525 \times 10^{11} \text{ C/Kg}$
 (d) $1.723 \times 10^{11} \text{ C/Kg}$

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(b)

9) Determine the Zeeman splitting of Cadmium red line 640 nm when the atom is placed in a magnetic field of 0.05 T .

- (a) $9.66 \times 10^{-13} \text{ m}$
 (b) $7.05 \times 10^{-11} \text{ m}$
 (c) $1.27 \times 10^{-13} \text{ m}$
 (d) $5.39 \times 10^{-11} \text{ m}$

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(a)

10) Find the maximum number of orders can be observed for a grating having 5000 lines per cm with sodium yellow light of wavelength 589.6 nm .

- (a) 2
 (b) 3
 (c) 4
 (d) 5

- (a)
 (b)
 (c)
 (d)

No, the answer is incorrect.

Score: 0

Accepted Answers:

(b)