PhysicsByAaryan

CSIR NET . GATE . JEST . BARC - Physics

Zeeman effect - CSIR NET Physics PYQs

Atomic and Molecular Physics . All PYQs (2015-2025) with answer key

7 questions . Answer key included

Q1. [June 2016] . 5.0 marks

Atomic and Molecular Physics > Zeeman effect

CSIR NET	2016 June	5M

In a normal Zeeman effect experiment using a magnetic field of strength 0.3 T , the splitting between the components of a 660 nm spectral line is

1. 12 pm
2. 10 pm
3. 3.8 pm
4. 6 pm

Q2. [Dec 2017] . 5.0 marks

Atomic and Molecular Physics > Zeeman effect

CSIR NET	2017 Dec	5M

The Zeeman shift of the energy of a state with quantum numbers L, S, J and m_J is

$$H_z = \frac{m_J \mu_B B}{J(J+1)} \left(\langle \vec{L}.\vec{J} \rangle + g_s \langle \vec{S}.\vec{J} \rangle \right)$$

Where B is the applied magnetic field, g_s is the g-factor for the spin and $\frac{\mu_B}{h} = 1.4\text{MHz} - G^{-1}$, where h is the Planck constant. The approximate frequency shift of the $S = 0, L = 1$ and $m_J = 1$ state, at a magnetic field of $1G$, is

1. 10 MHz
2. 1.4 MHz
3. 5 MHz
4. 2.8 MHz

Q3. [June 2017] . 5.0 marks

Atomic and Molecular Physics > Zeeman effect

CSIR NET	2017 June	5M

An atomic spectral line is observed to split into nine components due to Zeeman shift. If the upper state of the atom is $^3D_2$ then the lower state will be

1. $^3F_2$
2. $^3F_1$
3. $^3P_1$
4. $^3P_2$

Q4. [Dec 2023] . 5.0 marks

Atomic and Molecular Physics > Zeeman effect

CSIR NET	2023 Dec	5 M

A solar probe mission detects a fractional wavelength shift $(\Delta\lambda/\lambda)$ of the spectral line $\lambda = 630$ nm within a sunspot to be of the order of 10^{-5}. Assuming this shift is caused by the normal Zeeman effect (i.e., neglecting other physical effects), the estimated magnetic field (in tesla) within the observed sunspot is closest to

1. 3×10^{-5}
2. 300
3. 0.3
4. 3×10^{5}

Q5. [June 2023] . 5.0 marks

Atomic and Molecular Physics > Zeeman effect

CSIR NET	2023 June	5M

The red line of wavelength 644 nm in the emission spectrum of Cd corresponds to a transition from the $^1D_2$ level to the $^1P_1$ level. In the presence of a weak magnetic field, this spectral line will split into (ignore hyperfine structure)

1. 9 lines
2. 6 lines
3. 3 lines
4. 2 lines

Q6. [Dec 2025] . 5.0 marks

Atomic and Molecular Physics > Zeeman effect

CSIR NET	2025 Dec	5M	AMP

A hydrogen atom is in a weak external magnetic field $\vec{B}$. Consider an electron of this atom with $\left(l = 1, s = \frac{1}{2}\right)$ and total $j = \frac{3}{2}$. There are multiple energy levels for this electron due to the magnetic field. The energy spacing between any two adjacent levels (in units of $\mu_B B$) is

1. $\frac{1}{2}$
2. $\frac{1}{3}$
3. $\frac{3}{4}$
4. $\frac{4}{3}$

Q7. [June 2025] . 5.0 marks

Atomic and Molecular Physics > Zeeman effect

CSIR NET	2025 June	5M	AMP

An atom is subjected to a weak magnetic field $B = 0.1T$. A spectral line of wavelength 184.9 nm corresponding to a $J = 1$ to $J = 0$ transition splits into three components. The highest and the lowest components are separated by 3.2×10^{-4} nm. The magnetic moment of the atom in $J = 1$ state (in units of Bohr magneton) is

1. 2.82
2. 0.71
3. 1.41
4. 4.23

Answer Key

7 questions . Subject and topic for quick revision

Q. No	Subject	Topic	Answer
Q1	Atomic and Molecular Physics	Zeeman effect	**4**
Q2	Atomic and Molecular Physics	Zeeman effect	**2**
Q3	Atomic and Molecular Physics	Zeeman effect	**3**
Q4	Atomic and Molecular Physics	Zeeman effect	**3**
Q5	Atomic and Molecular Physics	Zeeman effect	**3**
Q6	Atomic and Molecular Physics	Zeeman effect	**4**
Q7	Atomic and Molecular Physics	Zeeman effect	**3**

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