

"Dissemination of Education for Knowledge, Science and Culture"
-Shikshanmaharshi Dr. Bapuji Salunkhe
Shri Swami Vivekanand Shikshan Sanstha, Kolhapur

Vivekanand College, Kolhapur (Autonomous)

Department of Physics

B.Sc. Part- III

Elements of Modern Physics

Surprise Test

Date : 17/10/2020

Day: - Saturday

Total Marks: 20

Time :- 2pm to 3pm

Instructions:-

- 1) All questions are compulsory.
- 2) Each question carries 5 marks.
- 3) Use of log table and calculator is allowed.

Q.1 Write a note on quantum numbers associated with vector atom model.

Q. 2 Explain spin orbit interaction.

Q. 3 What is Zeeman effect? Explain normal and anomalous Zeeman effect.

Q. 4 Explain Zeeman splitting of D1 and D2 lines.



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Vivekanand College, Kolhapur (Autonomous)
Department of Physics

B.Sc. III
Elements of Modern Physics
Surprise Test
Attendance Sheet

Date : 17/10/2020

Roll. No.	Name of Candidate	Sign
7756	Aishwarya Gaikwad.	<u>[Signature]</u>
7757	Geetali Santosh U.	<u>[Signature]</u>
7759	Chavan Ramchandra Ashok	<u>Ashok</u>
7760	More Mayuresh Laxman	<u>[Signature]</u>
7762	Jaydeep Prakash More	<u>JPMore</u>
7763	Akshada Vijay More.	<u>[Signature]</u>
7768	Omkar Dhiraj Patil	<u>Oprek</u>
7772	Satbhige Shivanand	<u>[Signature]</u>
7776	Shekar Avinash S.	<u>SSA</u>
7761	Gaurav Dinkar Kumbhar	<u>Gaurav</u>
7780	Sinde Siddharth V.	<u>[Signature]</u>
7784	Shingare Rahan Raju	<u>[Signature]</u>
7786	Jankambale Rohit Beliram	<u>Rohit</u>

Teacher Incharge.....
[Signature]

(Dr. M. M. Karanjikar)



[Signature]
Head of the
Department of Physics
Vivekanand College, Kolhapur.

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Vivekanand College, Kolhapur (Autonomous)

Department of Physics

B.Sc. III

Elements of Modern Physics

Surprise Test

Result

Date : 17/10/2020

Roll. No.	Marks	Roll. No.	Marks
7755	-	7778	-
7756	06	7779	-
7757	10	7780	12
7758	-	7781	-
7759	12	7782	-
7760	08	7783	-
7761	07	7784	10
7762	08	7785	-
7763	19	7786	10
7764	-		
7765	-		
7766	-		
7767	-		
7768	11		
7769	-		
7770	-		
7771	-		
7772	04		
7773	-		
7774	-		
7774	-		
7775	-		
7776	09		
7777	-		

Teacher Incharge.....

(Dr. M. M. Karanjkar)



Head of the
Department of Physics
Vivekanand College, Kolhapur.



08044

Signature of Jr. Super.

विवेकानंद कॉलेज (स्वायत्त) कोल्हापूर.

परीक्षेच्या

या विषयाच्या प्रयोग परीक्षा

Internal

Practical Examination in atomic physics.

at the _____ Examination

उमेदवाराचा आसन क्रमांक
(Candidate's Seat No.)विभाग
(Section)

उमेदवारांना सूचना

- प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
- उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
- कोणताही विद्युत्प्रयोग करण्यापूर्वी, प्रत्यक्ष पुरविलेली सर्व उपकरणे आणि सर्व 'कनेक्शन' नीट पाहून घेऊन संबंधित कामाची नीटनेटकी कार्ययोजना करण्याची नितांत आवश्यकता आहे आणि ह्या नंतर, पुढे काम चालू करण्याविषयी परीक्षकांची परवानगी मिळविणे आवश्यक आहे.
- सर्व निरीक्षणे कोष्टकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे शक्य तितक्या सुवाच्यपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
- प्रारंभिक किंवा अंतिम निरीक्षणात संख्यावाचक आकडे एकावर एक लिहू नयेत. जर लिहिलेला कोणताही आकडा नको असेल तर त्यावर एक रेष ओढून पाहिजे असलेला आकडा त्याच्याजवळ लिहा.
- प्रयोगशाळेतून बाहेर पडण्यापूर्वी आपले टेबल चांगल्या स्थितीत आहे याची खात्री करा.

INSTRUCTIONS TO CANDIDATES

- Read the question carefully and perform the experiment as required.
- If there be anything the apparatus that you do not know, ask the examiner or the laboratory assistant to help you,
- Before doing any electrical experiment, it is absolutely essential that you make a neat working sketch of all apparatus actually provided and of the necessary connection, and obtain the examiner's permission to proceed.
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(येथून लेखनास सुरवात करा.) (Begin writing here.)

- Q.1 Write a note on quantum numbers associated with vector atom model.
- Q.2 Explain spin orbit interaction.
- Q.3 what is zeeman effect ? Explain normal zeeman effect and anomalous zeeman effect.
- Q.4 Explain zeeman splitting of D₁ and D₂ lines.

Section	Q. No.											
	Marks											

प्र. क्र.

Q. No. 101

Quantum numbers :-

In vector atom model, angular momentum corresponding to different motions of electrons represented by certain vectors whose directions are perpendicular to the plane of motion and lengths are proportional to magnitude of the momentum the lengths are described by quantum numbers associated with various motions of electrons they are as follows,

1) Total and principle quantum number :- $[n]$

Total or principle quantum number gives the position of e^- in particular orbit. It is the number in Bohr-Sommerfeld model to represent the particular orbit. and it takes integral values like 1, 2, 3, 4, ... where $n=1$ corresponds to K shell, $n=2$ corresponds to L shell, $n=3$ corresponds to M shell and $n=4$ corresponds to N shell and so on...

2) Orbital quantum number :- (l)

It represents the orbital motion of e^- and 'l' take values from 0 to $n-1$. if $n=5$ then l take values 0, 1, 2, 3, 4

The orbital angular momentum is given by,
$$P_l = \frac{lh}{2\pi}$$

Section	Q. No.												
	Marks												

प्र. क्र.

Q. No.

In presence of external magnetic field there are three quantum numbers they are as follows,

1) Magnetic orbital quantum number :- (m_l)

It is the projection of l on the field direction. It takes integral values which is equal to $(2l+1)$ values including $-l$ to $+l$ including zero. If $l=1$ then $m_l = +1, 0$ if $l=2$ then $m_l = +2, +1, 0, -1, -2$ and which is equal to, $m_l = l \cos \alpha$, l is integer and value of $\cos \alpha$ should be in way to make m_l integer so values of m_l vary from $-l$ to $+l$ including zero.

2) Spin Magnetic Spin quantum number :- (m_s)

It is the projection of 'S' on field direction then it takes values $(2s+1)$ values which is equal to $(2s+1)$ orientations from field direction, the value of 'S' varies from $-s$ to $+s$ excluding zero the values of m_s equal to $1/2$ and $-1/2$ respectively.



08061

Signature of Jr. Super.

विवेकानंद कॉलेज (स्वायत्त) कोल्हापूर.

परीक्षेच्या

या विषयाच्या प्रयोग परीक्षा

Practical Examination in

at the Name: Gaurav Dinkar Kumbhar

Examination

उभेदवाराचा आसन क्रमांक
(Candidate's Seat No.)

7762

विभाग
(Section)

Atomic Physics (Bsc-III)

उभेदवारांना सूचना

- प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
- उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
- कोणताही विद्युत्प्रयोग करण्यापूर्वी, प्रत्यक्ष पुरविलेली सर्व उपकरणे आणि सर्व 'कनेक्शन' नीट पाहून घेऊन संबंधित कामाची नीटनेटकी कार्ययोजना करण्याची नितांत आवश्यकता आहे आणि ह्या नंतर, पुढे काम चालू करण्याविषयी परीक्षकांची परवानगी मिळविणे आवश्यक आहे.
- सर्व निरीक्षणे कोष्टकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे शक्य तितक्या सुवाचपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
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INSTRUCTIONS TO CANDIDATES

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(येथून लेखनास सुरवात करा.) (Begin writing here.)

01	Write Note for the following experiment
02	Verify the relation between the angle of incidence and angle of reflection
03	Verify the relation between the angle of incidence and angle of refraction
04	Verify the relation between the angle of incidence and angle of deviation
05	Verify the relation between the angle of incidence and angle of diffraction
06	Verify the relation between the angle of incidence and angle of scattering
07	Verify the relation between the angle of incidence and angle of polarization
08	Verify the relation between the angle of incidence and angle of dispersion
09	Verify the relation between the angle of incidence and angle of total internal reflection
10	Verify the relation between the angle of incidence and angle of critical angle

Section	Q. No.												
	Marks												

प्र. क्र.		
Q. No.	2	
	<p>We know that only valence electron is responsible for optical spectrum of Hydrogen ionised Helium and alkali metals. to explain fine structure. It is necessary to introduce the "spinning" of electron known as "spin correction"</p>	
	<p>The electrons of atoms revolves in orbits due to which it produce an orbital magnetic field. but at the same time, it revolves around shows spin motion, possess spin magnetic moment. "l_s"</p>	
	<p>the electron revolves in orbit produce magnetic orbital magnetic field \vec{B} and it's spin magnetic moment interact with each other.</p>	
	<p>Orbital magnetic field of revolving electron act on spin magnetic moment & or tries to pull it but due to rotational inertia of spin of electron, it revolves in the it can't get pulled. And coupling coupling is produced between orbital magnetic field with direction 'l' & spin magnetic moment 's'. Therefore electron revolves as whole, and make result in resultant 'J', that means</p>	

Section	Q. No.												
	Marks												

प्र. क्र.

Q. No.

' \vec{l} ' and ' \vec{s} ' precessiate to along resultant ' \vec{J} ' as shown in figure 'A' such precessions cause to change in energy. This precessional motion is called 'Larmor Precession'. & frequency of precessional motion is called 'Larmor Precessional frequency'.

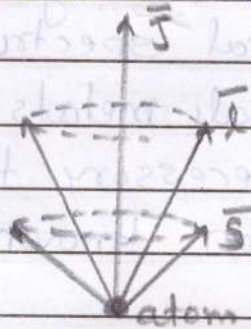


Fig A' Precession of ' \vec{l} ' & ' \vec{s} ' which is given by below eqⁿ

$$F_L = \frac{e}{4\pi m} \cdot B$$



8/20
08073

Signature of Jr. Super.

विवेकानंद कॉलेज (स्वायत्त) कोल्हापूर.

परीक्षेच्या

या विषयाच्या प्रयोग परीक्षा

Practical Examination in physics

at the _____ Examination

उमेदवाराचा आसन क्रमांक
(Candidate's Seat No.)

7761

विभाग
(Section)

Atomic physics

उमेदवारांना सूचना

1. प्रश्न काळजीपूर्वक वाचा आणि त्याप्रमाणे विचारलेला प्रयोग करा.
2. उपकरणांच्या वापराबाबत तुम्हांला काही माहीत नसेल तर परीक्षक किंवा प्रयोगशाळा सहाय्यक यांना तुम्हाला मदत करण्याविषयी विनंती करा.
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4. सर्व निरीक्षणे कोष्टकवजा तक्त्यात भरावी. मधल्या सर्व गणना आणि निर्णय हे शक्य तितक्या सुवाच्यपणे आणि स्पष्टपणे नोंदविलेले असणे हे हितावह आहे.
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6. प्रयोगशाळेतून बाहेर पडण्यापूर्वी आपले टेबल चांगल्या स्थितीत आहे याची खात्री करा.

INSTRUCTIONS TO CANDIDATES

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(येथून लेखनास सुरवात करा.) (Begin writing here.)

- | | |
|----|-----------------------------------------------------------------------------|
| Q1 | write a note on quantum number associ. associated with vector model |
| Q2 | expln spin orbit interaction |
| Q3 | what is zeeman effect? expln normal zeeman effect & anomalous zeeman effect |
| Q4 | expln zeeman splitting of D1 & D2 lines |

Section	Q. No.												
	Marks												

प्र. क्र.

Q. No.

Q1 → The various quantum number associated with single electron is follows :-

(1) total or principle quantum number (n) :-

The total or principle quantum number represented the orbital position of electron in orbit. That means bohr - sommerfeld model is represent the orbital number

(2) orbital quantum number (l)

The orbital quantum number (l) represent the orbital motion of electron. It take the value of 0 and n-1 i.e if n=5 then l = 0, 1, 2, 3, 4

(3) spin quantum number (s)

The spin quantum number represent the spin motion of electron in orbit

the spin angular momentum $p_s = \frac{sh}{2\pi}$

(4) total or resultant quantum number (J)

total or resultant quantum represent the orbital and spin angular momenta. The is the sum of orbital quantum number and spin quantum number

$$\vec{J} = \vec{L} + \vec{S}$$

Section	Q. No.												
	Marks												

प्र. क्र.

Q. No.

Q. No. l angular quantum number :-

the angular quantum number is represent the angular momenta of electron.

Q. No. m magnetic quantum number :-

magnetic quantum number represents the magnetic moment of electron in orbit.

Section	Q. No.												
	Marks												

प्र. क्र.		
Q. No.	Q3	<p>Zeeman effect is a magneto magneto-optic phenomena. If source of light producing line spectrum is placed in magnetic field. The spectral line are split into components. This splitting of spectral line due to external magnetic field is known as Zeeman effect.</p> <p>Normal Zeeman effect:- when magnetic field is comparatively strong then splitting of spectral line occur into two or three components is called as Normal Zeeman effect.</p> <p>Anomalous Zeeman effect:- when magnetic field is comparatively weak then splitting of spectral line occur into more than three component is called as anomalous Zeeman effect.</p>



08072

Signature of Jr. Super.

विवेकानंद कॉलेज (स्वायत्त) कोल्हापूर.

परीक्षेच्या

या विषयाच्या प्रयोग परीक्षा

Practical Examination in

Roll No. 7756

at the

Examination

उमेदवाराचा आसन क्रमांक

विभाग

Atomic physics

(Candidate's Seat No.)

(Section)

उमेदवारांना सूचना

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(येथून लेखनास सुरवात करा.) (Begin writing here.)

- Write a note on quantum number associated with vector
- explain spin orbit interaction
- what is zeeman effect? explain normal zeeman effect & anomalous zeeman effect.
- explain zeeman D₁ & D₂ line.

Section	Q. No.												
	Marks												

प्र. क्र.	Q. No.	1) Principle quantum number or total quantum number. It defines the position of electron in an orbit bohr. summerfield atomic model. it helps in derive the position of electron. Quantum number = 1, 2, 3, 4 etc. Therefore $k=1$, $l=2$, $m=3$, $n=4$ etc. so on.
		2) Orbital quantum number (l) :- Orbital quantum number define position of electron in subshells. orbital quantum number moment of electron = $P_l = \frac{lh}{2\pi}$
		3) Spin quantum number (s) :-

Section	Q. No.												
	Marks												

प्र. क्र.

Q. No. But. This turning was opposed by rotational inertia of electron on axis. as a result electron goes in precessional motion on the axis. The resultant \vec{L} & \vec{S} vector. as The it must have \vec{j} vector, are sited in space having invariable value. \vec{L} & \vec{S} vector work as a rigid system.