



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES**

**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION  
(SCIENCES)**

**2<sup>ND</sup> YEAR 1<sup>ST</sup> SEMESTER 2021/2022 ACADEMIC YEAR**

**MAIN REGULAR**

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**COURSE CODE: SPB 9203**

**COURSE TITLE: ATOMIC STRUCTURE AND BONDING**

**EXAM VENUE:**

**STREAM: (BEd. Science)**

**DATE:**

**TIME:**

**EXAM SESSION:**

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**INSTRUCTIONS:**

- 1. Answer question 1 (Compulsory) in section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**
- 4. Some important information/formulas are found on the last page of this question pape**

## SECTION A

### Question 1

- a) Derive Schrodinger in a three dimensional. (4 marks)
- b) Describe Rydberg studies on scattering of alpha particles into a metal foil. Why is the study very important in development of atomic structure (7 marks)
- c) Use Bohr's equation to determine the Bohr radius of H atom at  $n = 1$ .(7 marks)
- d) What is the difference between the Valency Bond Theory and Molecular Orbital Theory? (5 marks)
- e) State the concept of dualism of electron. (7 marks)

Section B. Answer any TWO questions

### Question 2

- a) Calculate the momentum of a particle which has a De-broglies' wavelength  $10^{-7}\text{m}$ . What will be velocity if the particle is an electron? (10 marks)
- b) According to the quantum theory of radiation the energy of a photon is equal to  $h\nu$ . Using the above hint , Derive De-broglies' fundamental equation describing  $\lambda$ . (7 marks)

### Question 3

- a) What is the energy of a photon of light with frequency  $3 \times 10^{15}\text{MHz}$ . Find out the wavelength of this radiation. (7 marks)
- b) Ionization energy of hydrogen is  $13.6\text{eV}$ .How much energy will be needed to ionize a hydrogen atom that is in it third excited state? (7 marks)
- c) Describe the bonding and anti-bonding in molecular orbital theory. (6 marks)

### Question 4

- a) Derive the Heisenberg Uncertainty principle. Why is this principle important in describing the position and the momentum of the particle in motion? (10 marks)
- b) The atomic numbers of He, Ne, Ar and Kr are 2, 10, 18 and 36 respectively. Briefly describe their ground state electronic configurations and comment upon their similarities or differences.. (10 marks)

### Question 5

a) Describe Bohr's postulates on the Bohr's model of hydrogen atom.

(10 marks)

b) With the help of Coloumb force of attraction between the nucleus and the electron moving in the  $n^{\text{th}}$  orbit with centrifugal force Derive Bohr's radius

(10 marks)

# Periodic table

1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18			
Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol	Atomic number, Z	Element symbol
1	H	2	He	3	Li	4	Be	5	B	6	C	7	N	8	O	9	F	10	Ne	11	Na	12	Mg	13	Al	14	Si	15	P	16	S	17	Cl	18	Ar		
1.008		4.00		6.94		9.01		10.81		12.01		14.01		16.00		19.00		20.18		22.99		24.31		26.98		28.09		30.97		32.06		35.45		39.95			
19	K	20	Ca	21	Sc	22	Ti	23	V	24	Cr	25	Mn	26	Fe	27	Co	28	Ni	29	Cu	30	Zn	31	Ga	32	Ge	33	As	34	Se	35	Br	36	Kr		
39.10		40.08		44.96		47.90		50.94		52.01		54.94		55.85		58.93		58.69		63.54		65.41		69.72		72.59		74.92		78.96		79.91		83.80			
37	Rb	38	Sr	39	Y	40	Zr	41	Nb	42	Mo	43	Tc	44	Ru	45	Rh	46	Pd	47	Ag	48	Cd	49	In	50	Sn	51	Sb	52	Te	53	I	54	Xe		
85.47		87.62		88.91		91.22		92.91		95.94		98.91		101.07		102.91		106.42		107.87		112.40		114.82		118.71		121.75		127.60		126.90		131.30			
55	Cs	56	Ba	57	La-Lu	72	Hf	73	Ta	74	W	75	Re	76	Os	77	Ir	78	Pt	79	Au	80	Hg	81	Tl	82	Pb	83	Bi	84	Po	85	At	86	Rn		
132.91		137.34		178.49		178.49		180.95		183.85		186.21		190.23		192.22		195.08		196.97		200.59		204.37		207.19		208.98		210		210		222			
87	Fr	88	Ra	89	Ac-Lr	104	Rf	105	Db	106	Sg	107	Bh	108	Hs	109	Mt	110	Ds	111	Rg	112	Uub	113	Nh	114	Fl	115	Mc	116	Lv	117	Ts	118	Og		
223		226.03		227.03		227.03		261		262		264		266		268		271		272		285		285		285		285		285		285		285			
Lanthanoids		Actinoids		57	La	58	Ce	59	Pr	60	Nd	61	Pm	62	Sm	63	Eu	64	Gd	65	Tb	66	Dy	67	Ho	68	Er	69	Tm	70	Yb	71	Lu				
				138.91		140.12		140.91		144.24		146.92		150.35		151.96		157.25		158.92		162.50		164.93		167.26		168.93		173.04		174.97					
				89	Ac	90	Th	91	Pa	92	U	93	Np	94	Pu	95	Am	96	Cm	97	Bk	98	Cf	99	Es	100	Fm	101	Md	102	No	103	Lr				
				227.03		232.04		231.04		238.03		237.05		239.05		241.06		244.07		249.08		252.08		252.09		257.10		258.10		259		262					

