

University of Information Technology & Sciences (UITS)
Faculty of Science and Engineering
Department of Computer Science and Engineering
Program: B.Sc. in CSE
Mid Term Examination, Spring 2025
Course Title: Engineering Chemistry
Course Code: CHEM0531111

Marks: 20

Time: 1(one) hour

(Answer all questions)

- | Q.No. | Questions | Marks |
|-------|---|-------|
| 1. a) | Figure 1(a) shows that Matter can act as waves like light and radiation, which also behave as particles. Derive and explain the de Broglie equation to justify the statement. | [03] |

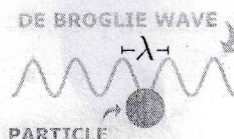


Figure 1(a)

- b) Some elements exist in different forms called isotopes, while others form ions by gaining or losing electrons. Understanding these subatomic particles helps in identifying elements and determining their properties. **Identify** the number of protons, neutrons, and electrons of the following atoms and ions. [04]

Element / Ion	Atomic Number (Z)	Mass Number (A)	Protons (P)	Neutrons (N)	Electrons (E)
Carbon-14					
Oxygen-17					
Sodium Ion-11 (Na^+)					
Hydrogen-2					
Sulfur-32 Ion (S^{2-})					
Potassium-39 (K)					

- c) The Figure 1(c) shows the history of the evolution of atomic theory which reflects a journey of scientific discovery, where each step has brought us closer to understanding the fundamental nature of matter. Now, **Compare** the advancement of the modern atomic theory using Figure 1(c). [03]



Figure 1(c)

2. a) In the microscopic world of atoms, electrons are not just randomly placed; they [04] follow specific rules defined by quantum numbers. These numbers determine an electron's energy level, shape, orientation, and spin, helping scientists predict an element's chemical behavior. According to the quantum number theory -

- Draw** s, p and d – orbital shapes and explain the reason for their different shape such structures.
- Show** quantum numbers that determines three orientations of p-orbitals, and mention their possible values.

b) The first widely accepted version of the periodic table was proposed by Dmitri [03] Mendeleev in 1869 [Table 2(b)]. Mendeleev arranged elements by increasing atomic mass, which led to the discovery of periodic patterns in their properties. Though he was so confident of his table, it has some limitations. **Identify** those limitations and **describe** how modern periodic table is different from Mendeleev's table.

Table 2(b)

Group	I		II		III		IV		V		VI		VII		VIII		
Oxide	R_2O		RO		R_2O_3		RO_2		R_2O_5		RO_3		R_2O_7		RO_4		
Hydride	RH		RH_2		RH_3		RH_4		RH_5		RH_6		RH_7		RH_8		
Periods	A	B	A	B	A	B	A	B	A	B	A	B	A	B			
1	H 1.008																
2	Li 6.93		Be 9.01		B 10.81		C 12.01		N 14.00		O 15.99		F 18.99				
3	Na 22.99		Mg 24.31		Al 26.98		Si 28.09		P 30.97		S 32.06		Cl 35.45				
4 1st Series	K 39.10		Ca 40.08		44		Ti 47.90		V 50.94		Cr 52.10		Mn 54.9		Fe 55.85		Co 58.93
2nd Series	Cu 63.5		Zn 65.4		68		72		As 74.9		Se 79.0		Br 79.9				Ni 58.71

c) As a Computer Science Engineer, understanding how chemistry is integrated into [03] the development of modern computing technologies can be crucial. Chemistry plays a significant role in areas like materials science, hardware development, energy storage, and even advancements in quantum computing. If you agree with the above statement, **explain** your opinion in brief. (You may use Figure 2(c) as reference)

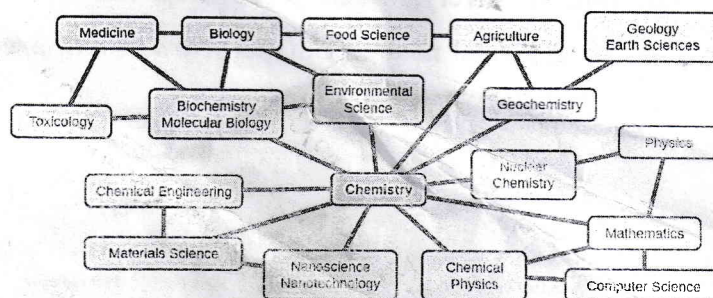


Figure 2(c)