

Department of CE / CSE / IT
 Program: B.Sc. in CE
 Mid Term Examination, Autumn 2024
 Course Title: Engineering Chemistry
 Course Code: CHEM 175 / CHEM 0531111 / CHEM 05311101 /
 CHEM 0531175

Marks: 20

Time: 1 (one) hour

(Answer all questions)

- | Q.No. | Questions | Marks |
|-------|--|-------|
| 1a | Hund's rule states that "the electrons will distribute themselves in different degenerate orbitals in such a way that maximum number of electrons remain in unpaired state with spin of same direction". Considering the rule, identify the correct option of orientation for the electrons entering in p orbitals. | 3 |

	P_x	P_y	P_z
(a)	↑		↑
(b)	↑	↓	
(c)		↑	↑
(d)	↓	↓	
(e)	↑↓		

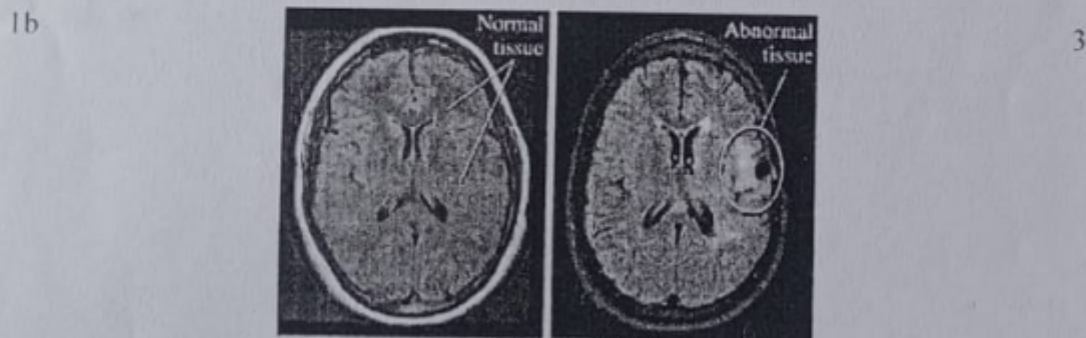


Figure 1(b)

The above images are the virtual representation of normal and abnormal tissue obtained from magnetic resonance imaging (MRI). Do you think that basic principle of MRI is evolved following the Bohr's atomic theory? **Relate** your answer with the basic principle of MRI.

- 1c Identify the electronic configurations of Na (11), Fe (26) according to the Aufbau principle and answer the followings: 4
- a. **Identify** the orbital to enter the last electron?
 - b. **Apply** *Hund's rule* to determine the orientation and spin of the electron of the last orbital.
 - c. **Identify** the set of quantum numbers for the last electron?
 - d. **Draw** the orientation of the orbital of the last electron.
- 2a If you could create a new element, what would its properties be, and where would it fit on the periodic table? **Explain** in details to justify your answer. 3
- 2b Elements of a specific block (s, p or d block in the periodic table) can form colorful compounds. Now, imagine that you have found two sets of fingerprints: one set is colorless, while the other is colorful. **Explain** why one element's fingerprints are so colorful, while the other is almost invisible? 3
- 2c Quantum numbers aren't just random; they're clues to the element's identity. Using your knowledge of atomic structure and orbital diagrams, **identify** the phenomena with orbital diagram for the following coordinates: 4
- i. 2, 1, +1, +1/2
 - ii. 3, 2, -2, +1/2