



No Paired p-electrons

A Level



Select which of the following elements has *no* paired p electrons in a single uncombined atom of the element:

- ☐ Oxygen
- ☐ Carbon
- ☐ Silicon
- ☐ Neon
- ☐ Magnesium

Adapted with permission from UCLES, A Level Chemistry, June 1990, Paper 1, Question 6



Electron configurations (D1.3)



Complete the following ground state electron configurations.

Part A K



What is the ground-state electron configuration of K?

Items:

[Ar] [Kr] [Xe] 3s 4s 2p 4p 3d 1 2 6

Part B Sc



What is the ground-state electron configuration of Sc?

[Ar] 3d

Items:

3s 4s 3p 4p 1 2 3 4 5 6

Part C Cr

What is the ground-state electron configuration of Cr?

[Ar] 3d

Items:

3s 4s 3p 4p 1 2 3 4 5 6

Part D Co

What is the ground-state electron configuration of Co?

[Ar] 3d

Items:

3s 4s 4p 1 2 3 5 6 7 8

Part E Cu

What is the ground-state electron configuration of Cu?

$1s^2 2s^2 2p^6 3s^2 3p^6 3d$

Items:

4s 4p 1 2 3 4 7 8 9 10

Based on question D1.3 from Physical Chemistry book



Electron configurations (D1.6)



Complete the following ground state electron configurations.

Part A Ti^{3+}



What is the ground-state electron configuration of Ti^{3+} ?

Items:

[Ar] [Kr] 3s 4s 3p 3d 4d 1 2 3 4

Part B Fe^{2+}



What is the ground-state electron configuration of Fe^{2+} ?

Items:

[Ar] [Kr] 3s 4s 3p 3d 4d 2 4 6 8

Part C Ni^{2+} 

What is the ground-state electron configuration of Ni^{2+} ?

Items:

[Ar] [Kr] 3s 4s 3p 3d 4d 2 4 6 8 10

Part D Cu^+ 

What is the ground-state electron configuration of Cu^+ ?

Items:

[Ar] [Kr] 3s 4s 3p 3d 4d 2 4 6 8 10

Part E Zn^{2+} 

What is the ground-state electron configuration of Zn^{2+} ?

$1s^2 2s^2 2p^6 3s^2$

Items:

4s 3p 3d 4d 1 2 4 6 8 9 10

Based on question D1.6 from Physical Chemistry book



Orbital Basics

A Level



Part A 5f subshell



Give the number of f-orbitals that comprise the 5f subshell.

Part B Number of electrons



Give the maximum number of electrons that can occupy a single orbital.

Part C Electrons in the second shell



Give the maximum number of electrons that can occupy the second shell.

Part D 3d subshell



Give the maximum number of unpaired electrons that can occupy the 3d subshell.

Part E Unpaired electrons



Give the number of unpaired electrons in the ground state of an oxygen atom.

Give the number of paired electrons in the ground state of the Na^+ ion.

Based on questions D2.1 and D2.2 from Physical Chemistry book

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Essential Pre-Uni Chemistry D2.3

Identify the subshell to which each of the orbitals below belongs.

Part A (a)

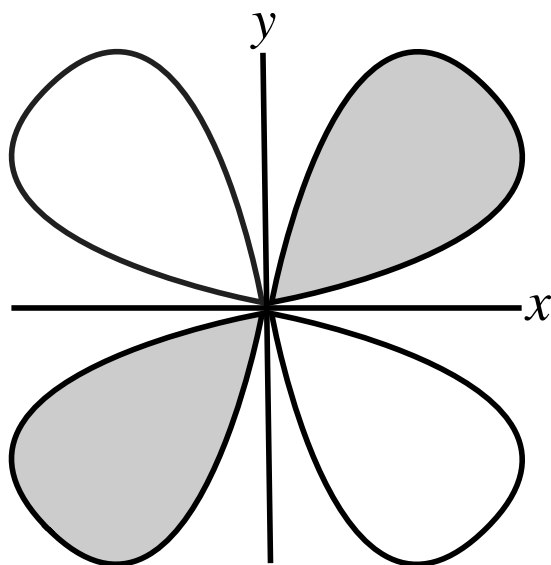


Figure 1: Unknown Orbital

What kind of orbital is depicted above?

- ☐ f
- ☐ s
- ☐ d
- ☐ p

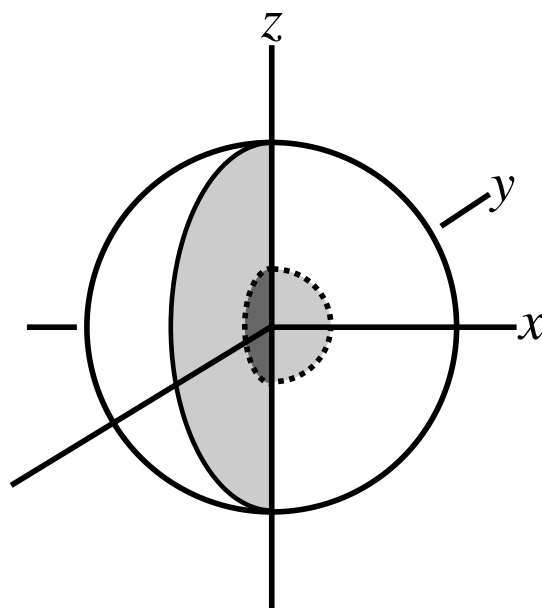


Figure 2: Unknown Orbital

What kind of orbital is depicted above?

- ☐ p
- ☐ d
- ☐ s
- ☐ f

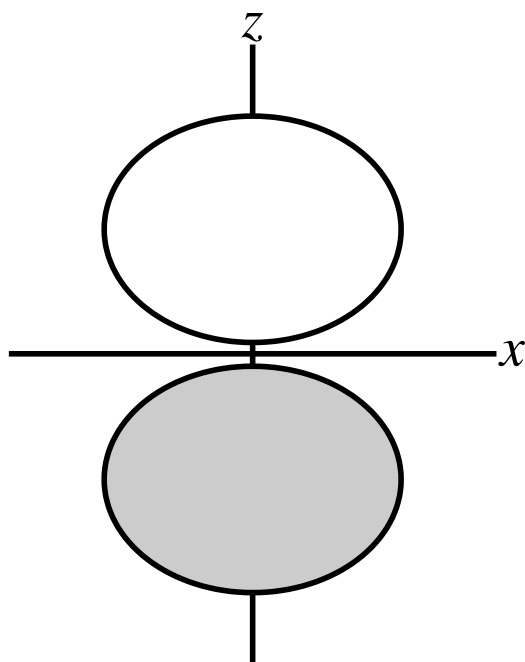


Figure 3: Unknown Orbital

What kind of orbital is depicted above?

- ☐ s
- ☐ d
- ☐ p
- ☐ f

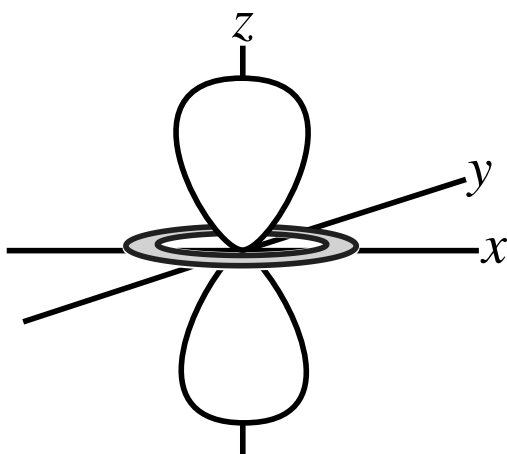


Figure 4: Unknown Orbital

What kind of orbital is depicted above?

- ☐ s
- ☐ p
- ☐ d
- ☐ f



First Configurations



Part A Unpaired electron

Specify the symbol of the element with the lowest atomic number that satisfies the following property: it has an unpaired electron in its ground-state configuration

Part B Incomplete shell, no unpaired electrons

Specify the symbol of the element with the lowest atomic number that satisfies the following property: it has an incomplete shell, but no unpaired electrons in its ground-state configuration

Part C Cation with unpaired electron

Specify the symbol of the element with the lowest atomic number that satisfies the following property: its singly-charged cation has an unpaired electron in its ground-state configuration

Part D Full shell configuration $^{2-}$ anion

Specify the symbol of the element with the lowest atomic number that satisfies the following property: its doubly-charged anion has only full shells in its ground-state configuration

Part E Cation and anion

Specify the symbol of the element with the lowest atomic number that satisfies the following property: both its singly-charged cation and its singly-charged anion have two unpaired electrons in their ground-state configurations

Part F Partially-filled p-orbital



Specify the symbol of the element with the lowest atomic number that satisfies the following property: it has a partially-filled p-orbital in its ground-state configuration.

Part G Fully-filled p-orbital



Specify the symbol of the element with the lowest atomic number that satisfies the following property: it has a fully-filled p-orbital in its ground-state configuration.

Part H Six unpaired electrons



Specify the symbol of the element with the lowest atomic number that satisfies the following property: it has six unpaired electrons in its ground-state configuration.

Part I Fully-filled d-orbital



Specify the symbol of the element with the lowest atomic number that satisfies the following property: it has a fully-filled d-orbital in its ground-state configuration.

Part J Fully-filled d-subshell



Specify the symbol of the element with the lowest atomic number that satisfies the following property: it has a fully-filled d-subshell in its ground-state configuration.



Essential Pre-Uni Chemistry D1.10

A Level



A 1^+ ion, in an excited state due to X-ray bombardment, is found to have an electron configuration $1s^2 2s^1 2p^6 3s^2 3p^6 3d^6 4s^2 4p^1$ in the gas phase.

Name the element whose ion this is.



Orbitals and Subshells

A Level



Part A Vanadium



Give the number of occupied orbitals in the ground state of a vanadium atom.

Part B Titanium



Give the highest occupied subshell in the Ti^{4+} ion.

Part C Bismuth



Give the number of electrons in p-orbitals in the ground state of the Bi^{3+} ion.

Based on questions D2.4, D2.5 and D2.6 from the Physical Chemistry book



Second Shell Orbital

A Level



What kind of orbital must an electron in the second shell occupy?

- ☐ A spherically-shaped orbital
- ☐ A dumb-bell-shaped orbital
- ☐ Either an s or p orbital
- ☐ The orbital closest to the nucleus

Adapted with permission from UCLES, A Level Chemistry, November 1995, Paper 4, Question 3



Four Unpaired Electrons

A Level



Select which of the following is the proton (atomic) number of an element that has four *unpaired* electrons in its ground-state:

- ☐ 6
- ☐ 14
- ☐ 16
- ☐ 22
- ☐ 26

Adapted with permission from UCLES, A Level Chemistry, June 1991, Paper 1, Question 4