

CHE151 Chapter 9 Problems
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1. Give the number of outer shell electrons and the number of unpaired electrons for each of the following.

(a) Ti (b) As (c) Cu (d) Kr (e) Ca

(a) 2 (b) 5 (c) 1 (d) 8 (e) 2

2. List the following in order of increasing size.

(a) Li, F, B, N, Be, Ne, O

(b) Ar, S⁻², Ca⁺², Cl⁻¹, K⁺, P⁻³

(a) Ne < F < O < N < B < Be < Li

(b) P⁻³ > S⁻² > Cl⁻¹ > Ar > K⁺ > Ca⁺²

3. Calculate the ionization potential, in kJ mol⁻¹ to

(a) remove all of the second shell electrons from gaseous F.

(b) remove all of the third shell electrons from gaseous Mg.

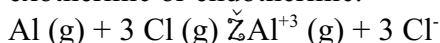
(a) 17.42 eV + 34.98 eV + 62.65 eV + 87.24 eV + 114.21 eV + 157.11 eV + 185.10 eV

= 658.71 eV

658.71 eV x 96.485 kJ mol⁻¹/eV = 6.3556 x 10⁴ kJ mol⁻¹

(b) 7.64 eV + 15.03 eV = 22.67 eV; 22.67 eV x 96.485 kJ mol⁻¹/eV = 2187 kJ mol⁻¹

4. Use electron affinities and ionization energies to determine if the following reaction is exothermic or endothermic.



ionization of Al: 5.98 eV + 18.82 eV + 28.44 eV = 53.24 eV

ionization of Cl: 3 x 3.61 eV = 10.83 eV

53.24 eV - 10.83 eV = 42.41 eV - endothermic

5. Which of the following have unpaired electrons? How many unpaired electrons?

(a) S⁻² (b) Sc⁺³ (c) Mo (d) Ni (e) Cl⁻

**(a) S⁻²[Ne] $\uparrow\downarrow$ $\uparrow\downarrow\uparrow\downarrow$; no unpaired electrons.
3s 3p**

(b) Sc⁺³[Ar]; no unpaired electrons.

**(c) Mo[Kr] $\uparrow\uparrow\uparrow\uparrow\uparrow\uparrow$ \uparrow ; 6 unpaired electrons.
4d 5s**

(d) Ni[Ar] $\uparrow\uparrow\uparrow\uparrow\uparrow\uparrow\uparrow\uparrow$ $\uparrow\uparrow$; 2 unpaired electrons.
3d 4s

(e) Cl[Ne] $\uparrow\uparrow$ $\uparrow\uparrow\uparrow\uparrow$; no unpaired electrons.
3s 3p

6. Europium has seven unpaired electrons. Give the electronic configuration for Eu. Do you expect Eu to be more paramagnetic than Fe? Why?

Eu[Xe]4f⁷6s²; Fe has 5 unpaired electrons. With more unpaired electrons, Eu should be more paramagnetic.