Homework for Chapter 5

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1. 有两种原子，在基态时其电子壳层是这样填充的：(1)$n=1$ 壳层、$n=2$ 壳层和 3s 次壳层都填满，3p 次壳层填了一半．(2)$n=1$ 壳层、$n=2$ 壳层、$n=3$ 壳层及 4s、4p、4d 次壳层都填满．试问这是哪两种原子？

The maximum number of electrons a shell may have is shown below

n	s	p	d	f	Total
1	2	0	0	0	2
2	2	6	0	0	8
3	2	6	10	0	18
4	2	6	10	14	32

So that the first atom has 15 electrons, which is Phosphor, the second one has 46 electrons, named in Palladium.

4. 原子中能够有下列量子数相同的最大电子数是多少？

(1) $n、l、m_l$；(2) $n、l$；(3) n.

Answers: (1) 2 (2) $2l+1$ (3) $2n^2$

5. 从实验得到的等电子体系 KI、CaII……等的莫塞莱图解，怎样知道从钾 Z＝19 开始不填 3d 而填 4s 次壳层，又从钪 Z＝21 开始填 3d 而不填4s 次壳层？

From this graph below we can know that

- for Potassium at $Z=19$, the spectroscopic term T of 3d is lesser than 4s.

- for Scandium at $Z = 21$, the spectroscopic term T of 3d is greater than 4s.

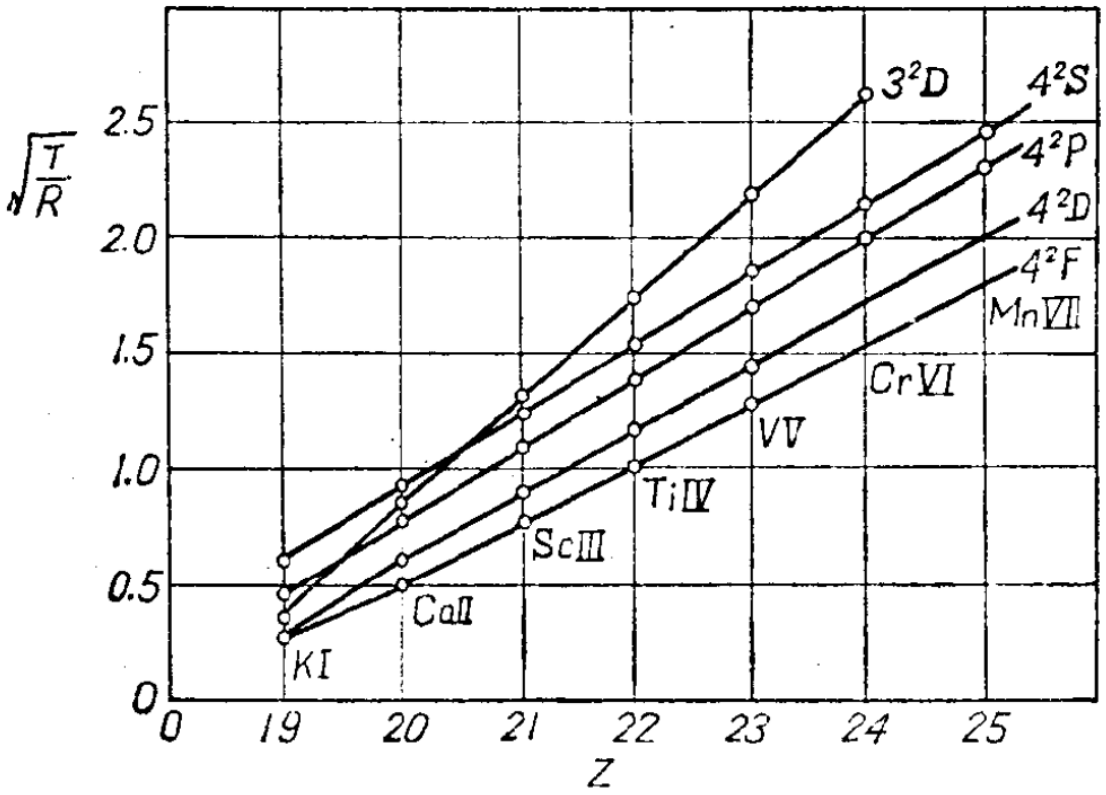

图 7.3 等电子体系 KI、CaII 等的莫塞莱图解

Since $E = -hcT$, the energy of electrons is inversely promotional to its spectroscopic term. So that

- for Potassium at $Z = 19$, the energy E of 3d is greater than 4s.
- for Scandium at $Z = 21$, the energy E of 3d is lesser than 4s.

This is the reason why electrons tend to fill the 4s layer of Potassium and tend to fill the 3d layer of Scandium.