

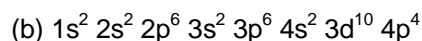
Revised August 2007

AP WORKED ANSWERS

2000, 7

Points 2, 2, 2, 2

(a) All six isotopes will have the same number of protons, and (as long as they are atoms with no charge) the same number of electrons. The isotopes will have different numbers of neutrons and hence different atomic masses.


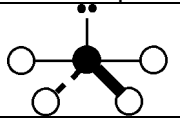


Hund's Rule tells us that no pairing of electrons in orbitals takes place until absolutely necessary. Therefore $4p^4$ can be better expressed as $4p_x^2 4p_y^1 4p_z^1$ showing two unpaired electrons.

(c) (i) Bromine and Selenium are in the same period and as result have the same number of electron shells and their outer electrons are both being removed from the same, 4p sub-shell. This means that there is no extra shielding on passing from Selenium to Bromine, but there is an extra proton. The increased nuclear charge coupled with no increased shielding means a greater attraction for the outermost electrons and therefore a larger first ionization energy for Bromine compared to Selenium.

(ii) Tellurium has an extra shell of electrons and with it comes extra shielding. The electron is being removed from a higher energy orbital further away from the nucleus. Despite the extra proton in Tellurium, the extra shielding is the dominant factor and therefore Selenium has a larger first ionization energy.

(d) SeF_4 has $6 + (4 \times 7) = 34$ valence electrons.

| Lewis dot structure | 3D Shape |
|---|---|
|  |  |
| 4BP, 1LP | See Saw (distorted tetrahedron) |

This is a polar molecule since the dipoles caused by electronegativity differences and the lone pair do not cancel.