

Comparison of Isoelectronic Species

Cl^- , Ar , and K^+

<https://gemini.google.com/app/cfc91d9475cd9bbd>

Response: The correct option is **(5) They have the same number of p electrons.**

Step-by-Step Analysis

The given species are Cl^- , Ar , and K^+ . All three species are **isoelectronic**, meaning they share the same electronic configuration ($1s^2 2s^2 2p^6 3s^2 3p^6$) with a total of 18 electrons.

1. Number of p electrons:

- Cl^- ($Z = 17, 18 e^-$): $1s^2 2s^2 2p^6 3s^2 3p^6 \implies 6 + 6 = 12$ p -electrons
- Ar ($Z = 18, 18 e^-$): $1s^2 2s^2 2p^6 3s^2 3p^6 \implies 6 + 6 = 12$ p -electrons
- K^+ ($Z = 19, 18 e^-$): $1s^2 2s^2 2p^6 3s^2 3p^6 \implies 6 + 6 = 12$ p -electrons

Since all three have 12 p electrons, statement (5) is true.

Analysis of Incorrect Options

- **(1) They have the same atomic/ionic mass:** False. They belong to different elements with distinct atomic masses ($\text{Cl} \approx 35.5$ u, $\text{Ar} \approx 40$ u, $\text{K} \approx 39$ u).
 - **(2) They have the same atomic/ionic radius:** False. For isoelectronic species, radius decreases as nuclear charge (Z) increases ($\text{Cl}^- > \text{Ar} > \text{K}^+$).
 - **(3) They have the same atomic number:** False. Their atomic numbers (Z) are different (17, 18, and 19 respectively).
 - **(4) The effective nuclear charge felt by an outermost electron of each species is the same:** False. Since shielding is nearly identical across these 18-electron species, $Z_{\text{eff}} \approx Z - S$ increases with atomic number (Z). Therefore, K^+ has the highest Z_{eff} and Cl^- has the lowest.
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