Is the most likely place to find the electron in an H atom at the nucleus \((r = 0)\) or at 1 Bohr radius distance \((r = 53 \text{ pm})\) from the nucleus?

a) At the nucleus, because \(\Psi^2\) for a 1s orbital is a maximum when \(r = 0\)
b) 53 pm from the nucleus, because \(4\pi r^2 \Psi^2\) for a 1s orbital is a maximum when \(r = 1a_0\) (1 Bohr radius)
c) Both – the first answer describes the most likely single point in space, while the second describes the most likely distance away from the nucleus
d) Neither – the electron is best described as a wave with indeterminate position, so the question is nonsensical

To determine the energy of a specific electron in a ground state argon atom, which kind(s) information do you need to know?

a) The shell of the electron
b) Whether the electron occupies an s orbital or a p orbital
c) Whether the electron has a positive or negative magnetic quantum number
d) Whether the electron is spin up or spin down

In a boron atom, the 2s orbital is lower energy than the 2p orbital because...

a) the 2s orbital has two electrons, but the 2p has only one
b) the 2s orbital can form a stronger \(\sigma\)-bond, but the 2p can form a weaker \(\pi\)-bond
c) the 2s orbital is more symmetric than the 2p
d) a 2s electron penetrates more closely to the nucleus than a 2p electron

For the 3p orbitals in phosphorus \((P)\), \(Z_{\text{eff}} = 4.89\). Which of the following is true?

a) The 3p orbitals of S must have \(Z_{\text{eff}} < 4.89\), because S has more electrons to screen the charge than P
b) The 2p orbitals of N must have \(Z_{\text{eff}} > 4.89\), because they are lower energy than 3p orbitals
c) The 3s orbitals of P must have \(Z_{\text{eff}} > 4.89\), because they penetrate closer to the nucleus than 3p
b) All orbitals of P have \(Z_{\text{eff}} = 4.89\), because all P atoms have the same Z value