

AP WORKSHEET 01G: ANSWERS

1.

- (a) Cu. Cations are formed by the loss of electrons, so are always smaller than their corresponding atoms, since the mutual repulsion between electrons is reduced, and in addition, often the number of occupied quantum levels is reduced by one
- (b) F⁻. Anions are formed by gaining electrons so are always larger than their corresponding atoms, since the mutual repulsion between electrons is increased
- (c) K. Atomic size increases with increasing number of electrons and increasing number of quantum occupied shells

2.

- (a) Atomic size decreases. Atomic size decreases with decreasing number of electrons and decreasing number of occupied quantum shells
- (b) Atomic size decreases. The same number of quantum shells are occupied, but the increasing nuclear charge causes the Coulombic attraction between the nucleus and the electrons to increase, thus shrinking the size of the atoms

3. (f) is the correct answer

4.

- (a) Blue. For the element with atomic number 3, lithium, the most common ion is a cation which will be smaller than the corresponding atom since it is formed by the loss of electrons (see Q1(a))
- (b) They all form cations and they are metals
- (c) They are noble gases that do not common form any ions

- (d) K, K⁺. Approx. 2.25×10^{-8} cm, 1.50×10^{-8} cm
- (e) They have common ionic radii that are larger than the corresponding atom
- (f) These elements represent the beginning of a new period on the periodic table and with it a new occupied quantum shell hence the jump in atomic size
- (g) Phosphorous is the element with atomic number 15 and it commonly forms the P³⁻ ion. Since anions are bigger than the corresponding atoms (see 1(b)), the red line would be larger than the blue line
- (h) The data is for the hydride, H⁻ ion. If H formed the hydrogen ion, H⁺ then the relative heights of the lines would be reversed
- (i) Nitrogen is the element with atomic number 7 and it commonly forms the N³⁻ ion. Since anions are bigger than the corresponding atoms (see 1(b)), the red line would be larger than the blue line

