SCH3U Periodic Trends and Quantum Quiz 2016   /52

Multiple Choice   /10
Identify the choice that best completes the statement or answers the question.

_____ 1. The person given credit for developing the first modern periodic table is
  a. Dalton   c. Thomson   d. Mendeleev   e. Chadwick
  b. Democritus

_____ 2. In the B-R model, the energy of an electron in an atom is quantized. This means that in an orbit, the energy of the electron:
  a. changes   c. is constant
  b. descreases with each orbit   d. increases with each orbit

_____ 3. Which of the following elements requires the least amount of energy to remove an electron from an atom to form an ion?
  a. O   b. Fr   c. K   d. He

_____ 4. Consider the equation $X_{(g)}$ + energy → $X^+_{(g)}$ + e^-. The "energy" term in the equation represents
  a. electron affinity   d. sublimation energy
  b. heat of sublimation   e. heat of vaporization
  c. ionization energy

_____ 5. Why does atomic radius increase from top to bottom in a chemical family?
  a. Nuclear charge increases from top to bottom in a chemical family.
  b. The number of electrons decreases from top to bottom in a chemical family.
  c. The number of energy levels increases from top to bottom in a chemical family.
  d. The number of energy levels decreases from top to bottom in a chemical family.

_____ 6. Which of the following is the most reactive metal element?
  a. cesium   b. lithuim   c. ununoctium   d. aluminum

_____ 7. Why is it easier to remove an electron from potassium than it is to remove an electron from calcium?
  a. Potassium has a higher electron affinity.
  b. Potassium has a higher ionization energy.
  c. Calcium has a lower electron affinity.
  d. Potassium has a lower nuclear charge.

_____ 8. Which of the following would have the highest electron affinity?
  a. potassium   b. helium   c. fluorine   d. oxygen

_____ 9. Elements X and Y are in the same chemical family. Element X has a first ionization energy of 7.646 eV. Element Y has a first ionization energy of 5.695 eV. Which is more reactive?
  a. X   b. Y   c. They are equally   d. not enough
                                                   reactive.   information

_____ 10. Elements A, B, C, and D (found in Groups 1–17) have atomic radii of 265 μm, 160 μm, 185 μm, and 175 μm, respectively. Which element will most likely have the highest ionization energy?

    a. A   b. B   c. C   d. D

Short Answer   **Answer on a separate sheet!**   **/42**

11. Explain how quantization of energy is analogous to a ball on a flight of steps. /2

12. How can a line spectrum be used to identify the particular element(s) present in a gas sample? /1

13. What is meant by the term "periodic trend"? /1

14. <u>Show</u> your calculations for the core charge of Li and N. <u>Explain</u> how these values relate to the difference in the atomic radii of these two elements. /4

15. Explain why the atomic radii of non-metal ions is increased relative to their neutral atoms? /2

16. <u>Explain</u> why Ba has a lower first ionization energy than Mg. /2

17. Examine the following 1st, 2nd, and 3rd ionization energies below.

    a. State which element is most likely a noble gas. /1

    b. Which element will likely form and 2+ ion? Justify, showing calculations for this element. /2

	1st (eV)	2nd (eV)	3rd (eV)
Element X	5.139	47.286	71.64
Element Y	7.646	15.035	80.143
Element Z	21.564	40.962	63.45

18. Why is it difficult to determine electron affinities for metals? /1

19. If an element has a high electron affinity would it most likely have a high or low ionization energy? Explain. /2

20. Make an argument for placing hydrogen in the halogen family rather than the alkali metals. /2

21. Which of the following would react most vigourosly to produce hydrogen gas? Explain your answer using your knowledge of periodic trends. He, Fr, Li, F /3

22. The reactivity of metals **increases** moving **down** a group, while the reactivity of non-metals **decreases** moving **down** a group. Use <u>specific periodic trends</u> to explain this observation. /3

23. For which of these properties does Li have a larger value than potassium? Explain your answers. /2
Properties: First ionization energy, atomic radius, ionic radius

24. While the Bohr-Rutherford model is able to predict and explain a great deal of atomic behaviours, there are exceptions to the predictions which indicate this model is inaccurate. Describe TWO observations (exceptions) that are not explained by Bohr-Rutherford.   /2

25. Identify 2 component of Dalton's atomic model that are still incorporated in current models of the atom. /2

26. Describe one significant difference between Dalton's model of the atom and all subsequent models.   /1

27. The accepted average atomic mass for Silicon is 28.1u. The following percent abundance data was collected from a mass spectrometer. Determine the percent abundance (x) of the isotope: $^{29}_{14}Si$.   /2

Isotope	$^{30}_{14}Si$	$^{29}_{14}Si$	$^{28}_{14}Si$
percent abundance	3.1%	x	92.2%

28. Write a full electron configuration for Nickel (Ni). /2

29. Consider the following electron configurations. Use your understanding of the quantum model to select the most likely configuration(s) for questions (a) to (c):   /5
    i. $1s^2 2s^2 p^6 3s^2 p^6 d^1 4s^2$
    ii. $1s^2 2s^2 p^6 3s^2 p^6 d^2 4s^2$
    iii. $1s^2 2s^2 p^6 3s^2$
    iv. $1s^2 2s^2 p^6 3s^2 p^6$
    v. $1s^2 2s^2 p^3$

    a. Which of these configurations would you expect to have highest IE_1?
    b. Which of these configurations would you expect to have the lowest IE_2?
    c. Which of these configurations corresponds to Mg?
    d. Which of these configurations would have anomalous I. E. based on a Bohr-R model? Explain