Chemistry R: Form TR4-6A Name _____

REVIEW Date _____ Period _____

Test Review № 4

Atomic Diagrams. Atomic diagrams show the number of protons and neutrons in the nucleus, and the distribution of electrons around the nucleus in energy levels. Atomic diagrams are extremely useful in predicting the ratios in which elements will combine. The information needed to draw atomic diagrams is found on the periodic table. The periodic table shows the atomic number which equals the number of protons or electrons, the atomic mass, and the electron configuration. It does not show the number of neutrons, but this can be determined by subtracting the atomic number from the atomic mass. This information can be used to draw a diagram.

Electron Dot Diagrams. Electron dot diagrams are a useful way to show the arrangement of outer electrons of an atom. They show valence electrons as dots at 12 o'clock, 3 o'clock, 6 o'clock, and 9 o'clock, and the rest of the atom, known as the kernel, as a symbol. Each of the clock positions represents one of the four outer orbitals. An orbital can hold a maximum of two electrons. The first orbital, represented by any one of the clock positions, is filled with a pair of electrons before putting electrons into the other orbitals. The remaining three orbitals each receive one electron before pairing occurs. Silicon, for example, has four valence electrons. As a result, it will have two electrons in one of the clock positions and one electron in each of two of the remaining three.

Development of the Periodic Table. Dmitri Mendeleev (1869) prepared a card for each of the known elements listing the symbol, the atomic mass, and the chemical properties. He arranged the cards in order of increasing atomic mass and noticed a pattern: *MENDELEEV'S PERIODIC LAW* – When the elements are arranged in increasing order of atomic mass, the chemical properties repeat themselves periodically. Moseley noticed that when all the elements were arranged in order of mass a few were not in the right family with respect to properties. He used a procedure called X-ray diffraction to determine the atomic number of the elements. When the elements were arranged in increasing order of atomic number, the discrepancies in Mendeleev's table disappeared. *THE PERIODIC LAW* – When the elements are arranged in increasing order of atomic number, the chemical properties repeat themselves periodically. The modern Periodic Table is arranged in order of increasing atomic number.

Organization of the Periodic Table. The modern Periodic Table is arranged in order of increasing atomic number in vertical columns and horizontal rows. The vertical columns are elements with about the same number of outer electrons (valence electrons). They are called groups or families. Elements in the same family have similar properties. Horizontal rows are elements with the same number of shells or energy levels. They are called periods. The major divisions of the Periodic Table are: Alkali metals - Group 1; Alkaline earth metals - Group 2; Halogens - Group 17; Noble gases (Inert gases) - Group 18; Transition metals - Groups 3-12; Lanthanides - Row 6, elements 57 - 71;and Actinides - Row 7, elements 89 - 103.

Trends in the Periodic Table. Going across the table from left to right within a row or period the number of protons increases, so the pull on the electrons increases. As a result the covalent atomic radius decreases and metallic properties decrease (except in the transition elements). In addition the number of valence electrons increases and the number of shells remains the same. Going down the table within a group or family the number of protons also increases, but the number of shells increases too. As a result, the atomic radius increases, the pull on the electrons decreases, and metallic properties increase. In a family the number of valence electrons remains the same. This results in the following organization of the Periodic Table:

	1							18
1	1 **M** 1	2	13	14	15	16	17	2 **N** 2 **O**
2	3 **E** 2-1	4 2-2	5 2-3	6 2-4	7 2-5	8 2-6	9 **N** 2-7 **O**	10 **B** 2-8 **L**
3	11 **T** 2-8-1	12 2-8-2	13 2-8-3	14 2-8-4	15 2-8-5	16 2-8-6	17 **N** 2-8-7 **M**	18 **E** 2-8-8
4	19 **A** 2-8-8-1	20 2-8-8-2					**E** **T**	**G** **A**
5	**L**						**A** **L**	**S** **E**
6	**S**						**S**	**S**
7								

Answer the questions below by circling the number of the correct response

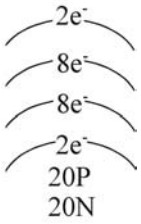
1. What is the atomic number of helium? (1) 1 (2) 2 (3) 3 (4) 4

2. Hydrogen–3 differs from hydrogen–1 in that hydrogen–3 has (1) 1 more proton, (2) 2 more protons, (3) 1 more neutron, (4) 2 more neutrons.

3. What is the mass number of carbon–14? (1) 12 amu (2) 14 amu (3) 6 amu (4) 8 amu

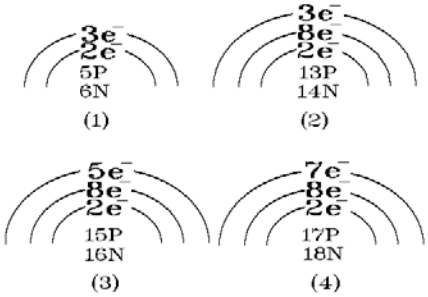
4. The property of all carbon atoms that is the same is (1) the mass, (2) the number of neutrons, (3) the number of protons, (4) the number of nucleons [particles in the nucleus]

5. Below is a Bohr-Rutherford diagram of an element.



Which element could be represented by this diagram? (1) calcium (2) cadmium (3) chlorine (4) no known element

6. Which of the following is a correct diagram of aluminum [Al]?



7. Which of the following is the correct electron dot diagram for helium?

(1) He (2) He (3) He (4) He

8. The number of neutrons in a typical atom with an electron configuration of 2–8–7 is (1) 17, (2) 18, (3) 35, (4) 7.

9. In the Periodic Table, the elements are arranged in order of increasing (1) atomic size, (2) atomic number, (3) atomic mass, (4) ionization energy

10. The chemical properties of the elements are periodic functions of their atomic (1) spin, (2) isotopes, (3) mass, (4) number.

11. Which pair contains elements which have the most similar chemical properties? (1) Mg and Ca (2) N and S (3) H and Li (4) Na and Cl

12. The element with an atomic number of 34 is most similar in its chemical behavior to the element with an atomic number of (1) 19 (2) 31 (3) 36 (4) 16

13. Silicon is most similar in chemical activity to (1) carbon, (2) lead, (3) sulfur, (4) nitrogen

14. The element 2–8–6 belongs in Period (1) 6, (2) 2, (3) 3, (4) 4

15. Most of the elements in the Periodic Table are classified as (1) metalloids, (2) nonmetals, (3) noble gases, (4) metals

16. Phosphorus is best classified as a (1) nonmetal, (2) metalloid, (3) metal, (4) transition element

17. The Group 1 metals all have the same (1) electronegativity, (2) atomic radius, (3) oxidation state, (4) ionization energy

18. Which Group in the Periodic Table contains the most active metals? (1) 1 (2) 2 (3) 13 (4) 14

19. In which Group of the Periodic Table would this element, 2–5, most likely be found? (1) 1 (2) 2 (3) 13 (4) 15

20. As the elements in Period 3 are considered in order of increasing atomic number, the number of principal energy levels in each successive element (1) decreases (2) increases (3) remains the same

21. Which Group contains elements which are metalloids? (1) 1 (2) 11 (3) 14 (4) 4

22. The elements with the least chemical reactivity are in Group (1) 1, (2) 18, (3) 3 (4) 16

23. Which element is a metalloid? (1) arsenic (2) neon (3) potassium (4) bromine

24. Which Group of elements exhibits all three phases of matter at room temperature? (1) 2 (2) 14 (3) 15 (4) 17

25. What are two properties of most nonmetals?
    (1) high ionization energy and poor electrical conductivity
    (2) high ionization energy and good electrical conductivity
    (3) low ionization energy and poor electrical conductivity
    (4) low ionization energy and good electrical conductivity

26. Which element is classified as a noble gas at STP? (1) hydrogen (2) neon (3) oxygen (4) nitrogen

27. In which shell are the valence electrons of the elements in Period 2 found? (1) 1 (2) 2 (3) 3 (4) 4

28. Of the following, which element has the smallest atomic radius? (1) Mg (2) Ca (3) Sr (4) Ba

29. As one proceeds from lithium to fluorine in the Periodic Table, the tendency for the elements to lose electrons (1) decreases, (2) increases, (3) remains the same

30. As the elements in Period 3 are considered from left to right, the ability of each successive element to gain electrons (1) decreases, (2) increases, (3) remains the same

31. Of the following, which is the element with the most metallic character in Group 16 is (1) O, (2) S, (3) Se, (4) Te

32. As the elements in Group 14 are considered in order of increasing atomic number, the metallic properties of successive elements (1) decreases, (2) increases, (3) remains the same

33. In Period 3 of the Periodic Table, the element with the smallest atomic radius is in Group (1) 1 (2) 2 (3) 15 (4) 17

34. Of the following, which Group 2 element has the greatest tendency to lose electrons? (1) calcium (2) barium (3) strontium (4) magnesium

35. Which Group in the Periodic Table contains atoms that have –2 oxidation states? (1) 1 (2) 2 (3) 16 (4) 17

36. The elements in Group 2 have similar chemical properties primarily because they have the same (1) ionization energies, (2) reduction potentials, (3) number of principal energy levels, (4) number of electrons in the outermost shell

37. As one proceeds from left to right across Period 2 of the Periodic Table, the decrease in atomic radius is primarily due to an increase in the number of (1) orbitals, (2) protons, (3) neutrons, (4) principal energy levels

38. The most active metal in Period 4 of the Periodic Table is (1) Fe, (2) Sc, (3) K, (4) Ca.

39. In Period 3, as the atomic numbers increase, the pattern according to which the properties of the elements change is
(1) metal → metalloid → nonmetal → noble gas
(2) metal → nonmetal → noble gas → metalloid
(3) nonmetal →metalloid → metal → noble gas
(4) nonmetal → metal → noble gas → metalloid

40. In going down the Group 15 elements on the Periodic Table, the metallic properties of the elements (1) decrease, (2) increase, (3) remain the same

41. As one proceeds from left to right across Period 3 of the Periodic Table, there is a decrease in (1) ionization energy (2) electronegativity (3) metallic characteristics (4) valence electrons

42. As one proceeds from fluorine to astatine in Group 17, the electronegativity (1) decreases and the atomic radius increases, (2) decreases and the atomic radius decreases, (3) increases and the atomic radius decreases, (4) increases and the atomic radius increases.

43. As the elements in Period 3 are considered in order of increasing atomic number, the number of principal energy levels in each successive element (1) decreases, (2) increases, (3) remains the same

44. If the elements are considered from top to bottom in Group 17 the number of electrons in the outermost shell will (1) decrease, (2) increase, (3) remain the same

45. Which represents the correct order of activity for the Group 17 elements [> means greater than]
(1) bromine > iodine > fluorine > chlorine
(2) fluorine > chlorine > bromine > iodine
(3) iodine > bromine > chlorine > fluorine
(4) fluorine > bromine > chlorine > iodine

46. Which is most characteristic of metals with very low ionization energies? (1) they are very reactive (2) they have a small atomic radius (3) they form covalent bonds (4) they have a high electronegativity

47. Metallic elements usually possess
(1) low electronegativities and high ionization energies
(2) high electronegativities and low ionization energies
(3) high electronegativities and high ionization energies
(4) low electronegativities and low ionization energies

48. If the members of Group 17 are arranged in order of increasing electronegativity, they are also arranged in order of increasing (1) ionization energy, (2) atomic radius, (3) atomic mass, (4) nuclear charge

49. As the elements are considered from top to bottom in Group15 of the Periodic Table, the ionization energy (1) decreases, (2) increases, (3) remains the same

50. An element that has both a high ionization energy and a high electronegativity is most likely a (1) metal (2) metalloid (3) nonmetal (4) noble gas

51. The element with the lowest first ionization energy in any given Period will always belong to Group (1) 1 (2) 2 (3) 17 (4) 18

52. An element that exhibits the largest variety of oxidation states is (1) Li (2) O (3) C (4) N

53. Which Group in the Periodic Table contains both metals and nonmetals? (1) 11 (2) 2 (3) 18 (4) 14

54. This element assumes only a +3 oxidation state in chemical combination (1) Na (2) Si (3) Al (4) Cl

55. Which Period contains elements that are all gases at STP ? (1) 1 (2) 2 (3) 3 (4) 4

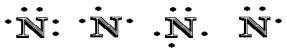
56. Which Group 18 (0) element in the ground state has a maximum of 2 completely filled principal energy levels? (1) Kr (2) Xe (3) He (4) Ne

57. A nonmetal which exists in the liquid state at room temperature is (1) aluminum (2) hydrogen (3) mercury (4) bromine

58. The only metal which is a liquid at STP is in Period (1) 5 (2) 6 (3) 3 (4) 4

59. Which Group contains an element that is a liquid at room temperature? (1) 18 (2) 2 (3) 16 (4) 17

60. Which of the following is the correct electron dot diagram for nitrogen?



(1) (2) (3) (4)

Answers

1. 2	16. 1	31. 4	46. 1
2. 4	17. 3	32. 2	47. 4
3. 2	18. 1	33. 4	48. 1
4. 3	19. 4	34. 2	49. 1
5. 1	20. 3	35. 3	50. 3
6. 2	21. 3	36. 4	51. 1
7. 2	22. 2	37. 2	52. 4
8. 2	23. 1	38. 3	53. 4
9. 2	24. 4	39. 1	54. 3
10. 4	25. 1	40. 2	55. 1
11. 1	26. 2	41. 3	56. 4
12. 4	27. 2	42. 1	57. 4
13. 1	28. 1	43. 3	58. 2
14. 3	29. 1	44. 3	59. 4
15. 4	30. 2	45. 2	60. 3