1. Which element would have properties characteristic of both a metal and a nonmetal?
   (1) Ag (3) Si
   (2) K (4) Xe

2. Which element in Period 3 has the greatest tendency to gain electrons?
   (1) Cl (3) Na
   (2) Ar (4) Si

3. Which statement best compares the atomic radius of a potassium atom and the atomic radius of a calcium atom?
   (1) The radius of the potassium atom is larger because of its larger nuclear charge.
   (2) The radius of the potassium atom is larger because of its smaller nuclear charge.
   (3) The radius of the potassium atom is smaller because of its larger nuclear charge.
   (4) The radius of the potassium atom is smaller because of its smaller nuclear charge.

4. What occurs as the atomic number of the elements in Period 2 increases?
   (1) The nuclear charge of each successive atom increases, and the atomic radius increases.
   (2) The nuclear charge of each successive atom increases, and the atomic radius decreases.
   (3) The nuclear charge of each successive atom decreases, and the atomic radius increases.
   (4) The nuclear charge of each successive atom decreases, and the atomic radius decreases.

5. Which element has properties most like those of magnesium?
   (1) potassium (3) calcium
   (2) sodium (4) cesium

6. Elements that readily gain electrons tend to have
   (1) low ionization energy and high electronegativity
   (2) low ionization energy and low electronegativity
   (3) high ionization energy and low electronegativity
   (4) high ionization energy and high electronegativity

7. As the elements in Group 2 are considered in order of increasing atomic number, the atomic radius of each successive element increases. This increase is primarily due to an increase in the number of
   (1) unpaired electrons
   (2) neutrons in the nucleus
   (3) electrons in the outermost shell
   (4) occupied electron shells

8. The reactivity of the metals in Groups 1 and 2 generally increases with
   (1) decreased mass
   (2) decreased nuclear charge
   (3) increased atomic radius
   (4) increased ionization energy

9. The element in Period 2 with the largest atomic radius is
   (1) a halogen
   (2) a noble gas
   (3) an alkali metal
   (4) an alkaline earth metal

10. Which element is *not* a metaloid?
    (1) boron (3) sulfur
    (2) arsenic (4) silicon

11. Which of the following ions has the *smallest* radius?
    (1) K^+ (3) Ca^{2+}
    (2) Na^+ (4) Mg^{2+}

12. A diatomic element with a high first ionization energy would most likely be a
    (1) metal with a low electronegativity
    (2) metal with a high electronegativity
    (3) nonmetal with a low electronegativity
    (4) nonmetal with a high electronegativity

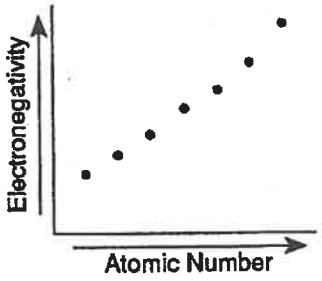
13. Low ionization energies are most characteristic of atoms that are
    (1) metalloids
    (2) noble gases
    (3) metals
    (4) nonmetals

14. A chloride dissolves in water to form a colored solution. The chloride could be
    (1) HCl
    (2) KCl
    (3) $CaCl_2$
    (4) $CuCl_2$

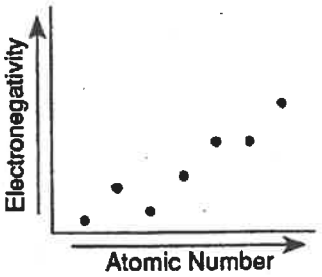
15. In the ground state, atoms of which of the following elements have the highest first ionization energy?
    (1) oxygen
    (2) nitrogen
    (3) boron
    (4) carbon

16. Which diagram correctly shows the relationship between electronegativity and atomic number for the elements of Period 3?

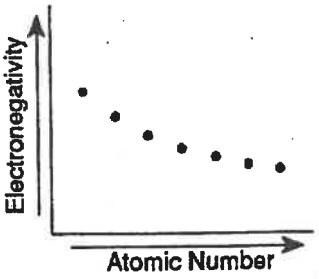
(1)



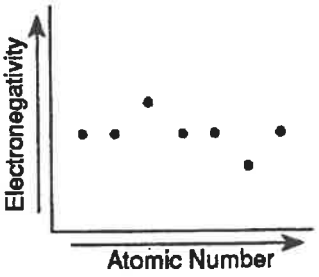
(2)



(3)



(4)



17. The first ionization energy of an element is 736 kilojoules per mole of atoms. An atom of this element in the ground state has a total of how many valence electrons?
    (1) 1
    (2) 2
    (3) 3
    (4) 4

18. Which sequence of elements is arranged in order of decreasing atomic radii?
(1) N, C, B
(2) Cl, Br, I
(3) Li, Na, K
(4) Al, Si, P

19. As the elements of Group 16 are considered from top to bottom on the Periodic Table, the covalent radii
(1) increase and the ionization energies decrease
(2) increase and the ionization energies increase
(3) decrease and the ionization energies increase
(4) decrease and the ionization energies decrease

20. Which is the most active nonmetal in the Periodic Table of the Elements?
(1) I
(2) Cl
(3) Na
(4) F

21. The highest ionization energies in any period are found in Group
(1) 1
(2) 2
(3) 17
(4) 18

22. For which element is the radius of its ion larger than the radius of its atom?
(1) F
(2) K
(3) Ca
(4) Na

23. As the elements Li to F in Period 2 of the Periodic Table are considered in succession, how do the relative electronegativity and the covalent radius of each successive element compare?
(1) The relative electronegativity decreases, and the atomic radius increases.
(2) The relative electronegativity decreases, and the atomic radius decreases.
(3) The relative electronegativity increases, and the atomic radius increases.
(4) The relative electronegativity increases, and the atomic radius decreases.

24. Which element in Group 17 is the most active nonmetal?
(1) I
(2) Br
(3) F
(4) Cl

25. Alkali metals, alkaline earth metals, and halogens are elements found respectively in Groups
(1) 1, 2, and 18
(2) 2, 13, and 17
(3) 1, 2, and 14
(4) 1, 2, and 17

26. Which element has the highest first ionization energy?
(1) phosphorus
(2) calcium
(3) aluminum
(4) sodium

27. Which elements atoms have a larger atomic radius than atoms of silicon?
(1) carbon
(2) sodium
(3) chlorine
(4) sulfur

28. As the atoms of the elements in Group 1 are considered in order from top to bottom, compared to the ionization energy of the atom above it, the ionization energy of each successive atom
(1) decreases
(2) increases
(3) remains the same

29. Which of the following ions has the *smallest* radius?
(1) K^+
(2) Ca^{2+}
(3) F^-
(4) Cl^-

30. The observed regularities in the properties of elements are periodic functions of their
(1) mass numbers
(2) atomic numbers
(3) non-valence electrons
(4) oxidation states

NAME: PERIOD:

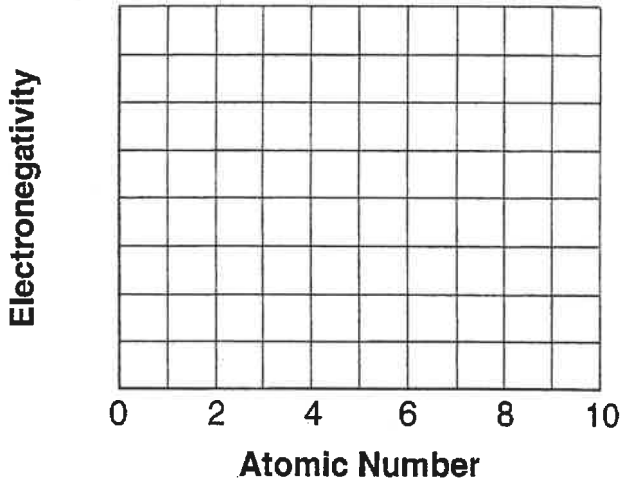
1. A knowledge of the *ionization energies* of elements can be very useful in predicting the activity and type of reaction an element will have.

   a What does the ionization energy quantitatively measure about an atom?

   b Why do ionization energies decrease from the top to the bottom of a group on the periodic table of elements?

   c Why do ionization energies increase from left to right across any period?

2. The table below shows the electronegativity of selected elements of the Periodic Table.



Element	Atomic Number	Electronegativity (g/mL)
Beryllium	4	1.6
Boron	5	2.0
Carbon	6	2.6
Fluorine	9	4.0
Lithium	3	1.0
Oxygen	8	3.4

a On the grid set up a scale for electronegativity on the y-axis. Plot the data by drawing a best-fit line.

b Using the graph, predict the electronegativity of nitrogen. _____

c For these elements, state the trend in electronegativity in terms of atomic number.