1. The arrangement of the elements from left to right in Period 4 on the Periodic Table is based on

   A) atomic mass
   B) atomic number
   C) the number of electron shells
   D) the number of oxidation states

2. The elements in Period 4 on the Periodic Table are arranged in order of increasing

   A) atomic radius
   B) atomic number
   C) number of valence electrons
   D) number of occupied shells of electrons

3. Which list of elements consists of a metal, a metalloid, and a nonmetal?

   A) Li, Na, Rb
   B) Cr, Mo, W
   C) Sn, Si, C
   D) O, S, Te

4. The elements on the Periodic Table are arranged in order of increasing

   A) atomic mass
   B) atomic number
   C) molar mass
   D) oxidation number

5. Which list includes elements with the most similar chemical properties?

   A) Br, Ga, Hg
   B) Cr, Pb, Xe
   C) O, S, Se
   D) N, O, F

6. The elements in Group 2 are classified as

   A) metals
   B) metalloids
   C) nonmetals
   D) noble gases

7. Compared to the atoms of nonmetals in Period 3, the atoms of metals in Period 3 have

   A) fewer valence electrons
   B) more valence electrons
   C) fewer electron shells
   D) more electron shells

8. The elements on the Periodic Table are arranged in order of increasing

   A) atomic mass
   B) atomic number
   C) first ionization energy
   D) selected oxidation state

9. On the modern Periodic Table, the elements are arranged in order of increasing

   A) atomic mass
   B) atomic number
   C) mass number
   D) oxidation number

10. Which quantity identifies an element?

    A) atomic number
    B) mass number
    C) total number of neutrons in an atom of the element
    D) total number of valence electrons in an atom of the element

11. The elements on the Periodic Table are arranged in order of increasing

    A) boiling point
    B) electronegativity
    C) atomic number
    D) atomic mass

12. Which list of elements contains a metal, a metalloid, and a nonmetal?

    A) Zn, Ga, Ge
    B) Si, Ge, Sn
    C) Cd, Sb, I
    D) F, Cl, Br

13. Which list consists of elements that have the most similar chemical properties?

    A) Mg, Al, and Si
    B) Mg, Ca, and Ba
    C) K, Al, and Ni
    D) K, Ca, and Ga

14. Five cubes of iron are tested in a laboratory. The tests and the results are shown in the table below.

Iron Tests and the Results

Test	Procedure	Result
1	A cube of Fe is hit with a hammer.	The cube is flattened.
2	A cube of Fe is placed in 3 M HCl(aq).	Bubbles of gas form.
3	A cube of Fe is heated to 1811 K.	The cube melts.
4	A cube of Fe is left in damp air.	The cube rusts.
5	A cube of Fe is placed in water.	The cube sinks.

Which tests demonstrate chemical properties?

A) 1, 3, and 4 B) 1, 3, and 5 C) 2 and 4 D) 2 and 5

15. Which property can be defined as the ability of a substance to be hammered into thin sheets?

A) conductivity B) malleability
C) melting point D) solubility

16. At STP, which element is a good conductor of electricity?

A) chlorine B) iodine
C) silver D) sulfur

17. A solid element that is malleable, a good conductor of electricity, and reacts with oxygen is classified as a

A) metal B) metalloid
C) noble gas D) nonmetal

18. Which elements are malleable and good conductors of electricity?

A) iodine and silver B) iodine and xenon
C) tin and silver D) tin and xenon

19. An element that has a low first ionization energy and good conductivity of heat and electricity is classified as a

A) metal B) metalloid
C) nonmetal D) noble gas

20. Which substance can *not* be decomposed by ordinary chemical means?

A) methane B) mercury
C) ethanol D) ammonia

21. Which statement describes a chemical property of iron?

A) Iron can be flattened into sheets.
B) Iron conducts electricity and heat.
C) Iron combines with oxygen to form rust.
D) Iron can be drawn into a wire.

22. Which list of symbols represents nonmetals, only?

A) B, Al, Ga B) Li, Be, B
C) C, Si, Ge D) P, S, Cl

23. Which phrase describes the molecular structure and properties of two solid forms of carbon, diamond and graphite?

A) the same molecular structures and the same properties
B) the same molecular structures and different properties
C) different molecular structures and the same properties
D) different molecular structures and different properties

24. Which element has chemical properties that are most similar to the chemical properties of fluorine?

A) boron B) chlorine
C) neon D) oxygen

25. Which element is classified as a nonmetal?

A) Be B) Al C) Si D) Cl

26. A characteristic of a nonmetal is

A) low ionization energy
B) high electronegativity
C) high electrical conductivity
D) the ability to form positive ions

27. Properties of nonmetal atoms include

A) low ionization energy and low electronegativity
B) low ionization energy and high electronegativity
C) high ionization energy and low electronegativity
D) high ionization energy and high electronegativity

28. Which statement explains why neon is a Group 18 element?

A) Neon is a gas at STP.
B) Neon has a low melting point.
C) Neon atoms have a stable valence electron configuration.
D) Neon atoms have two electrons in the first shell.

29. An atom of argon in the ground state tends *not* to bond with an atom of a different element because the argon atom has

A) more protons than neutrons
B) more neutrons than protons
C) a total of two valence electrons
D) a total of eight valence electrons

30. An atom in the ground state has a stable valence electron configuration. This atom could be an atom of

A) Al B) Cl C) Na D) Ne

31. Which list of elements contains a metal, a metalloid, and a nonmetal?

A) Ag, Si, I_2 B) Ge, As, Ne
C) K, Cu, Br_2 D) S, Cl_2, Ar

32. Which element is a metalloid?

A) Al B) Ar C) As D) Au

33. Which Group 14 element is a metalloid?

A) tin B) silicon
C) lead D) carbon

34. Which element has both metallic and nonmetallic properties?

A) Rb B) Rn C) Si D) Sr

35. The element in Group 14, Period 3 on the Periodic Table is classified as a

A) metal B) noble gas
C) metalloid D) nonmetal

36. Which pair of symbols represents a metalloid and a noble gas?

A) Si and Bi B) As and Ar
C) Ge and Te D) Ne and Xe

37. Pure silicon is chemically classified as a metalloid because silicon

A) is malleable and ductile
B) is an excellent conductor of heat and electricity
C) exhibits metallic and nonmetallic properties
D) none of the above

38. Which element has six valence electrons in each of its atoms in the ground state?

A) Se B) As C) Kr D) Ga

39. The number of valence electrons in each atom of an element affects the element's

A) chemical properties
B) number of isotopes
C) decay mode
D) half-life

40. The elements in Group 2 have similar chemical properties because each atom of these elements has the same

A) atomic number
B) mass number
C) number of electron shells
D) number of valence electrons

41. What is the total number of valence electrons in a germanium atom in the ground state?

A) 22 B) 2 C) 32 D) 4

42. Which element has an atom in the ground state with a total of three valence electrons?

A) aluminum B) lithium
C) phosphorus D) scandium

43. Which atom has the largest atomic radius?

A) potassium B) rubidium
C) francium D) cesium

44. As the elements is Period 3 are considered in order of increasing atomic number, there is a general *decrease* in

A) atomic mass
B) atomic radius
C) electronegativity
D) first ionization energy

45. An atom of which element has the largest atomic radius?

A) Fe B) Mg C) Si D) Zn

46. As atomic number increases within Group 15 on the Periodic Table, atomic radius

A) decreases, only
B) increases, only
C) decreases, then increases
D) increases, then decreases

47. How do the atomic radius and metallic properties of sodium compare to the atomic radius and metallic properties of phosphorus?

A) Sodium has a larger atomic radius and is more metallic.
B) Sodium has a larger atomic radius and is less metallic.
C) Sodium has a smaller atomic radius and is more metallic.
D) Sodium has a smaller atomic radius and is less metallic.

48. Which list of elements from Group 2 on the Periodic Table is arranged in order of increasing atomic radius?

A) Be, Mg, Ca B) Ca, Mg, Be
C) Ba, Ra, Sr D) Sr, Ra, Ba

49. The data table below shows elements *Xx, Yy,* and *Zz* from the same group on the Periodic Table.

Element	**Atomic Mass** (atomic mass unit)	**Atomic Radius** (pm)
Xx	69.7	141
Yy	114.8	?
Zz	204.4	171

What is the most likely atomic radius of element *Yy*?

A) 103 pm B) 127 pm C) 166 pm D) 185 pm

50. Which list of elements is arranged in order of increasing electronegativity?

A) Be, Mg, Ca B) F, Cl, Br
C) K, Ca, Sc D) Li, Na, K

51. Which statement describes the general trends in electronegativity and atomic radius as the elements in Period 2 are considered in order from left to right?

A) Both electronegativity and atomic radius increase.
B) Both electronegativity and atomic radius decrease.
C) Electronegativity increases and atomic radius decreases.
D) Electronegativity decreases and atomic radius increases.

52. Which atom has the greatest attraction for the electrons in a chemical bond?

A) hydrogen B) oxygen
C) silicon D) sulfur

53. Which general trends in first ionization energy and electronegativity values are demonstrated by Group 15 elements as they are considered in order from top to bottom?

A) The first ionization energy decreases and the electronegativity decreases.
B) The first ionization energy increases and the electronegativity increases.
C) The first ionization energy decreases and the electronegativity increases.
D) The first ionization energy increases and the electronegativity decreases.

54. Which element has atoms with the strongest attraction for electrons in a chemical bond?

A) chlorine B) nitrogen
C) fluorine D) oxygen

55. Which atom has the *weakest* attraction for electrons in a chemical bond?

A) a boron atom B) a calcium atom
C) a fluorine atom D) a nitrogen atom

56. Which statement describes the general trends in metallic properties as the elements in Period 2 are considered in order of increasing atomic number?

A) Metallic properties remains same.
B) Metallic properties increase.
C) Metallic properties increase and then decrease.
D) Metallic properties decrease.

57. Which general trend is demonstrated by the Group 17 elements as they are considered in order from top to bottom on the Periodic Table?

A) a decrease in atomic radius
B) a decrease in electronegativity
C) an increase in first ionization energy
D) an increase in nonmetallic behavior

58. Based on Reference Table S, atoms of which of these elements have the strongest attraction for the electrons in a chemical bond?

A) Al B) Si C) P D) S

59. The strength of an atom's attraction for the electrons in a chemical bond is the atom's

A) electronegativity B) ionization energy
C) heat of reaction D) heat of formation

60. Which statement describes the general trends in electronegativity and first ionization energy as the elements in Period 3 are considered in order from Na to Cl?

A) Electronegativity increases, and first ionization energy decreases.
B) Electronegativity decreases, and first ionization energy increases.
C) Electronegativity and first ionization energy both increase.
D) Electronegativity and first ionization energy both decrease.

61. Which atom in the ground state requires the *least amount of energy to remove its valence electron?*

A) lithium atom B) potassium atom
C) rubidium atom D) sodium atom

62. Samples of four Group 15 elements, antimony, arsenic, bismuth, and phosphorus, are in the gaseous phase. An atom in the ground state of which element requires the *least* amount of energy to remove its most loosely held electron?

A) As B) Bi C) P D) Sb

63. Which general trend is found in Period 2 on the Periodic Table as the elements are considered in order of increasing atomic number?

A) decreasing atomic mass
B) decreasing electronegativity
C) increasing atomic radius
D) increasing first ionization energy

64. The amount of energy required to remove the outermost electron from a gaseous atom in the ground state is known as

A) first ionization energy
B) activation energy
C) conductivity
D) electronegativity

65. How much energy is required to remove the most loosely bound electron from a neutral atom of carbon in the gaseous phase?

A) 363 kJ B) 441 kJ
C) 1086 kJ D) 1242 kJ

66. In Period 2 of the Periodic Table, which Group contains the element with the highest first ionization energy?

A) alkali metals
B) alkaline earth metals
C) halogens
D) noble gases

67. As elements of Group 15 of the Periodic Table are considered in order from top to bottom, the metallic character of the atoms of each successive element generally

A) decreases B) increases
C) remains the same

68. In which of the following elements is the *least* amount of energy required to remove the most loosely bound electron from an atom in the gaseous state?

A) Sr B) Ar C) Al D) Cl

69. Which element in Group 1 has the greatest tendency to lose an electron?

A) cesium B) potassium
C) rubidium D) sodium

70. 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?

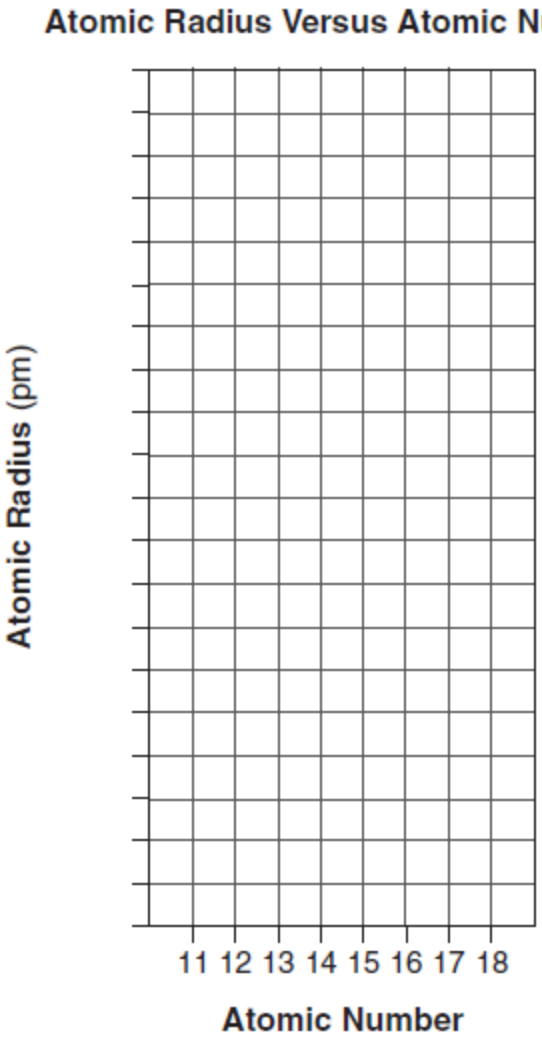
A) 1 B) 2 C) 3 D) 4

Base your answers to questions **71** and **72** on the information below.

The atomic number and corresponding atomic radius of the Period 3 elements are shown in the data table below.

Data Table

Atomic Number	**Atomic Radius** (pm)
11	160.
12	140.
13	124
14	114
15	109
16	104
17	100.
18	101



71. Explain, in terms of electrons, the change in radius when a sodium atom becomes a sodium ion.

72. On the grid above, plot the data from the data table. Circle and connect the points.

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73. Base your answer to the following question on the information below.
The ionic radii of some Group 2 elements are given in the table below.

Ionic Radii of Some Group 2 Elements

Symbol	**Atomic Number**	**Ionic Radius** (pm)
Be	4	44
Mg	12	66
Ca	20	99
Ba	56	134

On the same grid, plot the data from the data table. Circle and connect the points.

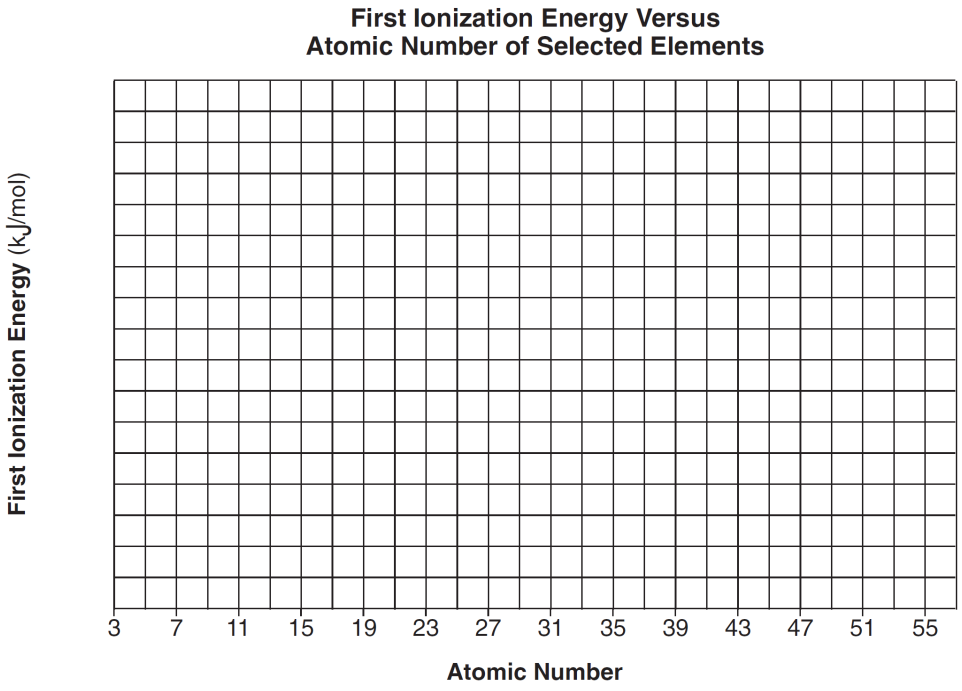
74. Base your answer to the following question on "the table below.

First Ionization Energy of Selected Elements

Element	Atomic Number	First Ionization Energy (kJ/mol)
lithium	3	520
sodium	11	496
potassium	19	419
rubidium	37	403
cesium	55	376

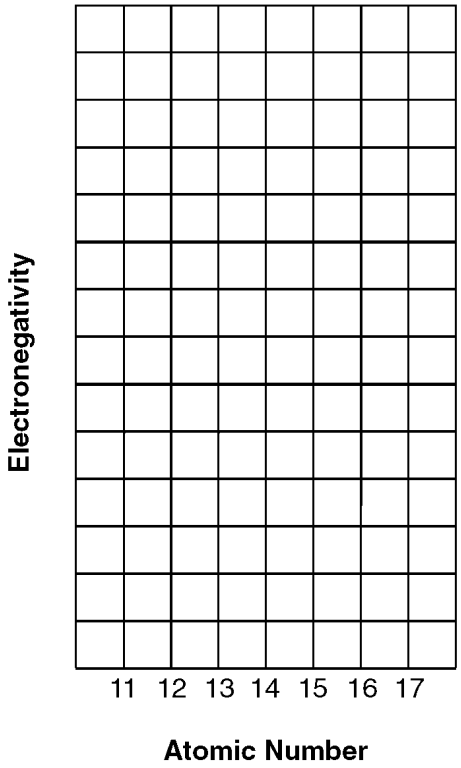
"

On a grid, mark an appropriate scale on the axis labeled "First Ionization Energy (kj/mol)." An appropriate scale is one that allows a trend to be seen.



75. Base your answer to the following question on the data table provided.

Atomic Number	Electronegativity
11	
12	
13	
14	
15	
16	
17	

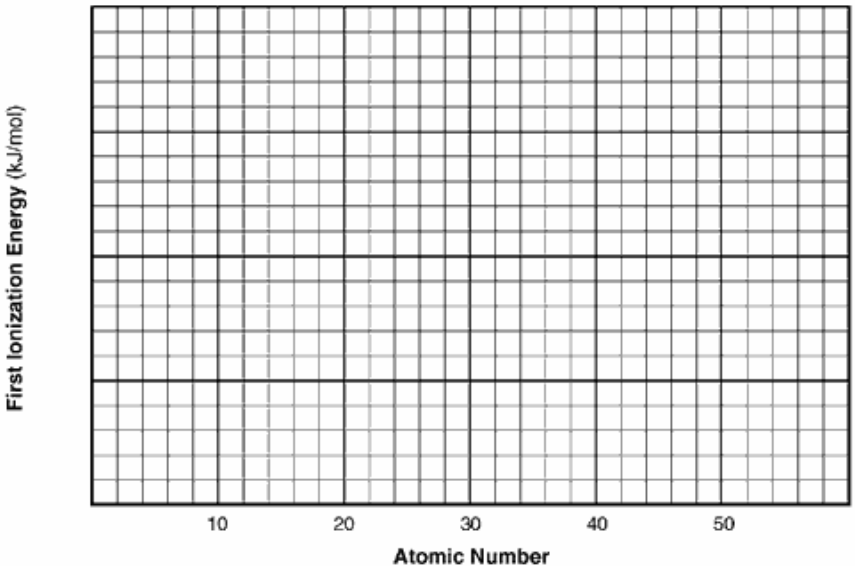


On the same grid, plot the data from the data table. Circle and connect the points.

76. Base your answer to the following question on the *Reference Tables for Physical Setting/Chemistry.*

Atomic Number	Element	First Ionization Energy (kJ/mol)
2	He	
10	Ne	
18	Ar	
36	Kr	
54	Xe	

Example: 



a Complete the data table provided for the following Group 18 elements: He, Ne, Ar, Kr, Xe

b Using information from your data table in part *a*, construct a line graph on the grid provided, following the directions below.

• Mark an appropriate scale on the axis labeled "First Ionization Energy (kJ/mol). "

• Plot the data from your data table. Circle each point and connect the points.

c Based on your graph in part *b*, describe the trend in first ionization energy of Group 18 elements as the atomic number increases.