

Unit 3- Periodic Table Review Problems

- ___ 1) On the present *Periodic Table of the Elements*, the elements are arranged according to increasing
- A) atomic mass
 - B) atomic number
 - C) number of neutrons
 - D) number of oxidation states
- ___ 2) In Period 3, from left to right in order, each successive element will
- A) decrease in electronegativity
 - B) increase in number of protons
 - C) increase in metallic character
 - D) decrease in atomic mass
- ___ 3) In which shell are the valence electrons of the elements in Period 2 found?
- A) 1
 - B) 2
 - C) 3
 - D) 4
- ___ 4) Which set of symbols represents atoms with valence electrons in the same electron shell?
- A) Mn, Hg, Cu
 - B) Sr, Sn, I
 - C) O, S, Te
 - D) Ba, Br, Bi
- ___ 5) In which list are the elements arranged in order of increasing atomic mass?
- A) Te, I, Xe
 - B) Ne, F, Na
 - C) Cl, K, Ar
 - D) Fe, Co, Ni
- ___ 6) An unknown element X can form a compound with the formula XBr_3 . In which group on the Periodic Table would element X be found?
- A) 1
 - B) 13
 - C) 14
 - D) 2
- ___ 7) As each successive element in Group 15 of the Periodic Table is considered in order of increasing atomic number, the atomic radius
- A) remains the same
 - B) decreases
 - C) increases
- ___ 8) As the elements in Period 2 of the Periodic Table are considered in succession from left to right, there is a decrease in atomic radius with increasing atomic number. This may *best* be explained by the fact that the
- A) number of protons decreases, and the number of shells of electrons increases
 - B) number of protons increases, and the number of shells of electrons remains the same
 - C) number of protons decreases, and the number of shells of electrons remains the same
 - D) number of protons increases, and the number of shells of electrons increases
- ___ 9) Compared to the nonmetals in Period 2, the metals in Period 2 generally have larger
- A) atomic radii
 - B) atomic numbers
 - C) ionization energies
 - D) electronegativities
- ___ 10) What occurs when an atom loses an electron?
- A) The atom's radius decreases and the atom becomes a positive ion.
 - B) The atom's radius increases and the atom becomes a positive ion.
 - C) The atom's radius decreases and the atom becomes a negative ion.
 - D) The atom's radius increases and the atom becomes a negative ion.
- ___ 11) When an atom becomes a positive ion, the radius of the atom
- A) decreases
 - B) remains the same
 - C) increases
- ___ 12) Compared to the radius of a chlorine atom, the radius of a chloride ion is
- A) smaller because chlorine gains an electron
 - B) smaller because chlorine loses an electron
 - C) larger because chlorine loses an electron
 - D) larger because chlorine gains an electron

- ___ 13) Given the equation: $\text{:}\ddot{\text{F}}\cdot + 1e^{-} \longrightarrow \left[\text{:}\ddot{\text{F}}\text{:}\right]^{-}$
- This equation represents the formation of a
- A) fluoride ion, which is larger in radius than a fluorine atom
- B) fluorine atom, which is larger in radius than a fluoride ion
- C) fluoride ion, which is smaller in radius than a fluorine atom
- D) fluorine atom, which is smaller in radius than a fluoride ion
- ___ 14) Which of the following ions has the *smallest* radius?
- A) F^{-} C) K^{+}
- B) Rb^{+} D) Cl^{-}
- ___ 15) A metal, M , forms an oxide compound with the general formula $M_2\text{O}$. In which group on the Periodic Table could metal M be found?
- A) Group 1 C) Group 2
- B) Group 17 D) Group 16
- ___ 16) The elements located in the lower left corner of the Periodic Table are classified as
- A) noble gases C) nonmetals
- B) metalloids D) metals
- ___ 17) Which of the following Group 15 elements has the *greatest* metallic character?
- A) nitrogen C) phosphorus
- B) bismuth D) antimony
- ___ 18) The high electrical conductivity of metals is primarily due to
- A) high ionization energies
- B) mobile electrons
- C) high electronegativities
- D) filled energy levels
- ___ 19) Which of these elements is the *best* conductor of electricity?
- A) N C) Ni
- B) Br D) S
- ___ 20) Which element is malleable and can conduct electricity in the solid phase?
- A) iodine C) sulfur
- B) tin D) phosphorus
- ___ 21) What is a property of most metals?
- A) They are poor conductors of electricity.
- B) They are poor conductors of heat.
- C) They tend to gain electrons easily when bonding.
- D) They tend to lose electrons easily when bonding.
- ___ 22) What are two properties of *most* nonmetals?
- A) low ionization energy and good electrical conductivity
- B) high ionization energy and poor electrical conductivity
- C) low ionization energy and poor electrical conductivity
- D) high ionization energy and good electrical conductivity
- ___ 23) Which element is a brittle, nonconducting solid at 25°C ?
- A) Br C) Bi
- B) S D) Al
- ___ 24) Element X is a solid that is brittle, lacks luster, and has six valence electrons. In which group on the Periodic Table would element X be found?
- A) 1 C) 15
- B) 2 D) 16
- ___ 25) At STP, an element that is a brittle solid and a poor conductor of heat and electricity could have an atomic number of
- A) 17 C) 13
- B) 16 D) 12
- ___ 26) Which change occurs when a barium atom loses two electrons?
- A) It becomes a negative ion and its radius decreases.
- B) It becomes a positive ion and its radius decreases.
- C) It becomes a positive ion and its radius increases.
- D) It becomes a negative ion and its radius increases.
- ___ 27) The element in Group 14, Period 3 on the Periodic Table is classified as a
- A) nonmetal C) metal
- B) noble gas D) metalloid
- ___ 28) Which list of elements contains two metalloids?
- A) Po, Sb, I, Xe
- B) As, Bi, Br, Kr
- C) Si, Ge, Po, Pb
- D) Si, P, S, Cl
- ___ 29) Which pair of symbols represents a metalloid and a noble gas?
- A) As and Ar C) Si and Bi
- B) Ne and Xe D) Ge and Te
- ___ 30) Which of these elements has physical and chemical properties most similar to silicon (Si)?
- A) phosphorus (P)
- B) germanium (Ge)
- C) chlorine (Cl)
- D) lead (Pb)

- ___ 31) Which trends are observed as each of the elements within Group 15 on the Periodic Table is considered in order from top to bottom?
- Their metallic properties decrease and their atomic radii decrease.
 - Their metallic properties increase and their atomic radii decrease.
 - Their metallic properties increase and their atomic radii increase.
 - Their metallic properties decrease and their atomic radii increase.
- ___ 32) At standard pressure, which element has a melting point higher than standard temperature?
- Hg
 - Br₂
 - Fe
 - F₂
- ___ 33) Elements Q, X, and Z are in the same group on the Periodic Table and are listed in order of increasing atomic number. The melting point of element Q is -219°C and the melting point of element Z is -7°C. Which temperature is *closest* to the melting point of element X?
- 226°C
 - 101°C
 - 219°C
 - 7°C
- ___ 34) As the elements in Group 17 are considered in order of increasing atomic number, the chemical reactivity of each successive element
- remains the same
 - increases
 - decreases
- ___ 35) The amount of energy required to remove the outermost electron from a gaseous atom in the ground state is known as
- electronegativity
 - first ionization energy
 - conductivity
 - activation energy
- ___ 36) As the elements of Group 1 on the Periodic Table are considered in order of increasing atomic radius, the ionization energy of each successive element generally
- remains the same
 - increases
 - decreases
- ___ 37) Which trends are observed when the elements in Period 3 on the Periodic Table are considered in order of increasing atomic number?
- The atomic radius decreases, and the first ionization energy generally decreases.
 - The atomic radius decreases, and the first ionization energy generally increases.
 - The atomic radius increases, and the first ionization energy generally decreases.
 - The atomic radius increases, and the first ionization energy generally increases.
- ___ 38) From which of these atoms in the ground state can a valence electron be removed using the *least* amount of energy?
- chlorine
 - oxygen
 - nitrogen
 - carbon
- ___ 39) Based on the *Properties of Selected Elements* chemistry reference table, which of the following atoms requires the *least* energy for the removal of the most loosely bound electron?
- Br
 - Sr
 - Be
 - Sn
- ___ 40) The strength of an atom's attraction for the electrons in a chemical bond is the atom's
- heat of reaction
 - heat of formation
 - electronegativity
 - ionization energy
- ___ 41) Which of the following elements has the *highest* electronegativity?
- Al
 - H
 - Ca
 - K
- ___ 42) Which of these elements has the *lowest* melting point?
- K
 - Na
 - Li
 - Rb
- ___ 43) Which element has chemical properties that are *most* similar to the chemical properties of sodium?
- Mg
 - Cl
 - K
 - Se
- ___ 44) As the atoms of the Group 17 elements in the ground state are considered from top to bottom, each successive element has
- an increasing number of valence electrons and identical chemical properties
 - an increasing number of valence electrons and similar chemical properties
 - the same number of valence electrons and similar chemical properties
 - the same number of valence electrons and identical chemical properties

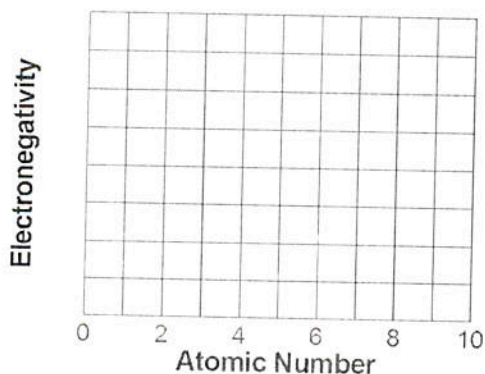
- ___ 45) As the elements in Group 17 on the Periodic Table are considered from top to bottom, what happens to the atomic radius and the metallic character of each successive element?
- A) The atomic radius and the metallic character both decrease.
 B) The atomic radius decreases and the metallic character increases.
 C) The atomic radius increases and the metallic character decreases.
 D) The atomic radius and the metallic character both increase.
- ___ 46) In which group of the Periodic Table do most of the elements exhibit *both* positive and negative oxidation states?
- A) 7
 B) 17
 C) 2
 D) 12
- ___ 47) Which element is classified as a noble gas at STP?
- A) nitrogen
 B) neon
 C) oxygen
 D) hydrogen
- ___ 48) Which element is a noble gas?
- A) krypton
 B) manganese
 C) antimony
 D) chlorine
- ___ 49) Which species does *not* have a noble gas electron configuration?
- A) Na^+
 B) S
 C) Mg^{2+}
 D) Ar
- ___ 50) Which group of the Periodic Table contains atoms with a stable outer electron configuration?
- A) 8
 B) 16
 C) 1
 D) 18
- ___ 51) At STP, the element oxygen can exist as either O_2 or O_3 gas molecules. These two forms of the element have
- A) the same chemical and physical properties
 B) different chemical properties and the same physical properties
 C) different chemical and physical properties
 D) the same chemical properties and different physical properties
- ___ 52) At STP, solid carbon can exist as graphite or as diamond. These two forms of carbon have
- A) different properties and the same crystal structures
 B) the same properties and different crystal structures
 C) different properties and different crystal structures
 D) the same properties and the same crystal structures
- ___ 53) In the 19th century, Dmitri Mendeleev predicted the existence of a then unknown element X with a mass of 68. He also predicted that an oxide of X would have the formula $X_2\text{O}_3$. On the modern Periodic Table, what is the group number and period number of element X ?
- ___ 54) Given: Samples of Na, Ar, As, Rb
- (a) Which *two* of the given elements have the most similar chemical properties?
 (b) Explain your answer to part (a) in terms of the *Periodic Table of the Elements*.
- ___ 55) As a neutral sulfur atom gains two electrons, what happens to the radius of the atom?
- ___ 56) After a neutral sulfur atom gains two electrons, what is the resulting charge of the ion?
- ___ 57) Element X is a solid metal that reacts with chlorine to form a water-soluble binary compound.
- Based on the given statement, state *one* physical property of element X that makes it a good material for making pots and pans.

Questions 58 and 59 refer to the following:

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

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

- ___ 58) (a) On the grid below, set up a scale for electronegativity on the y-axis.
- (b) Plot the data by drawing a best-fit line.



- (c) Using the graph, predict the electronegativity of nitrogen.

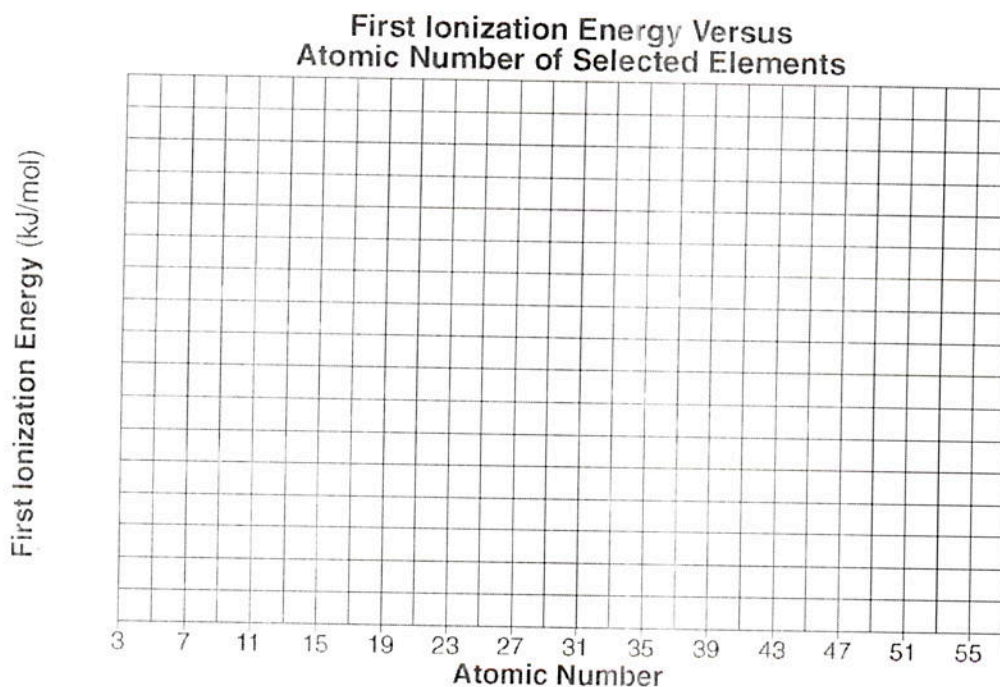
- ___ 59) For the elements in the table, state the trend in electronegativity in terms of atomic number.

Questions 60 through 62 refer to the following:

**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

- ___ 60) (a) On the grid provided, 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.



- (b) On the same grid, plot the data from the table. Circle and connect the points.

EXAMPLE:

___ 61) State the trend in first ionization energy for the elements in the table shown as the atomic number increases.

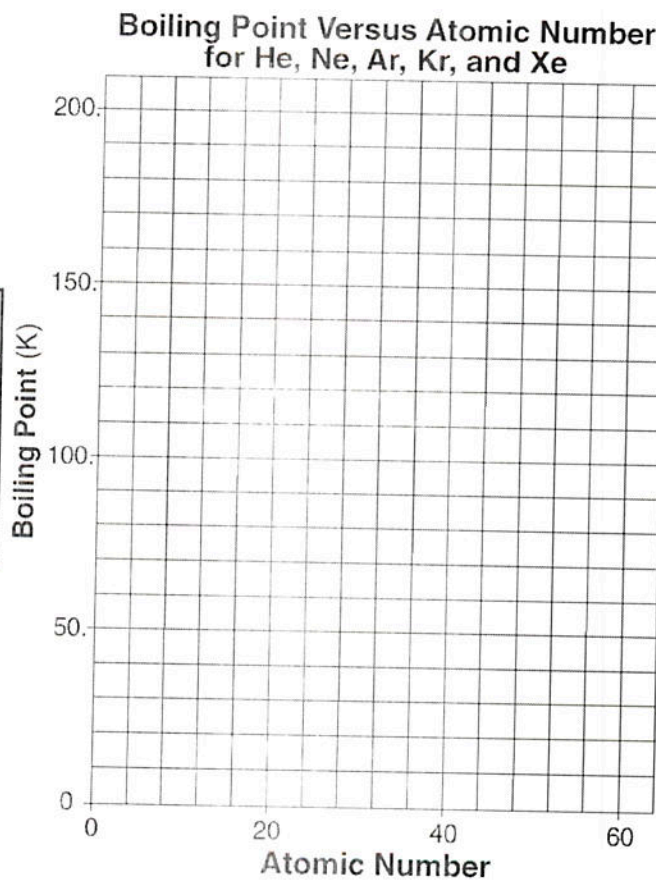
___ 62) Explain, in terms of atomic structure, why cesium has a lower first ionization energy than the rubidium in the given table.

___ 63) Use the data in the *Properties of Selected Elements* chemistry reference table to answer the following.

(a) On the data table below, record the boiling points for He, Ne, Ar, Kr, and Xe.

Data Table

Symbol	Atomic Number	Boiling Point (K)
He	2	
Ne	10	
Ar	18	
Kr	36	
Xe	54	



(b) Plot the boiling point versus the atomic number for He, Ne, Ar, Kr, and Xe. Circle and connect the points.

EXAMPLE:

(c) Based on your graph, describe the trend in the boiling points of these elements as the atomic number increases.

PERIODIC TABLE

Answer Key 1887 - 1 - Page 1

- 1) B 2) B 3) B 4) B 5) C
6) B 7) C 8) B 9) A 10) A
11) A 12) D 13) A 14) A 15) A
16) D 17) B 18) B 19) C 20) B
21) D 22) B 23) B 24) D 25) B
26) B 27) D 28) C 29) A 30) B
31) C 32) C 33) B 34) C 35) B
36) C 37) B 38) D 39) B 40) C
41) B 42) D 43) C 44) C 45) D
46) B 47) B 48) A 49) B 50) D
51) C 52) C

53) Group 13 and Period 4

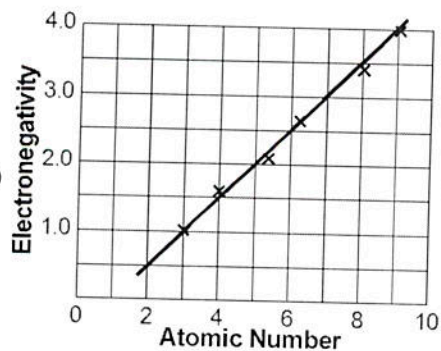
54) (a) Na and Rb;

(b) SAMPLE ANSWERS: same number of valence electrons OR Group 1 OR Elements in the same group (family) have similar chemical properties. OR Both lose one electron when they react.

55) SAMPLE ANSWERS: gets bigger OR increases OR The ion is larger than the atom.

56) -2 OR negative

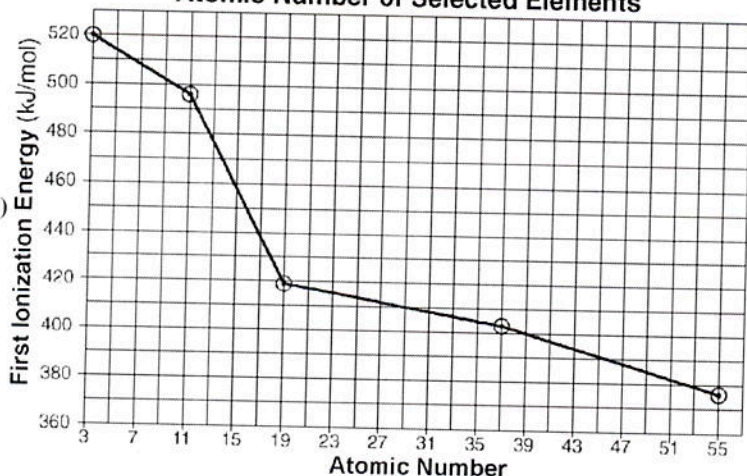
57) SAMPLE ANSWERS: conducts heat OR high melting point OR It is malleable.



58) (a-b) ; (c) $3.0 (\pm 0.2)$

59) SAMPLE ANSWER: As atomic number increases, electronegativity increases.

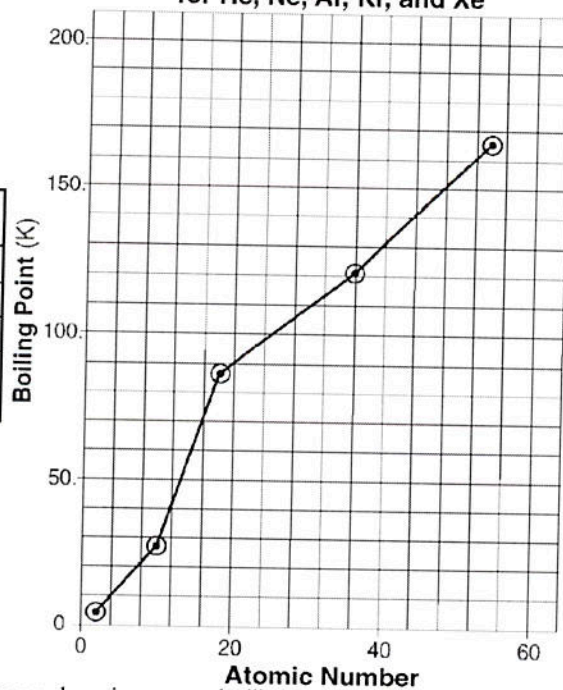
First Ionization Energy Versus Atomic Number of Selected Elements



60) (a-b)

- 61) SAMPLE ANSWERS: As atomic numbers increases, first ionization energy decreases. OR Ionization energy decreases.
- 62) SAMPLE ANSWERS: As atomic radius increases, valence electrons are more easily removed. OR The force of attraction between the nucleus and the valence electrons decreases down the group. OR cesium has more shells, easier to remove electrons

Boiling Point Versus Atomic Number for He, Ne, Ar, Kr, and Xe



Data Table

Symbol	Atomic Number	Boiling Point (K)
He	2	4
Ne	10	27
Ar	18	87
Kr	36	121
Xe	54	166

63) (a-b)

- (c) SAMPLE ANSWER: As atomic numbers increases, boiling point increases.