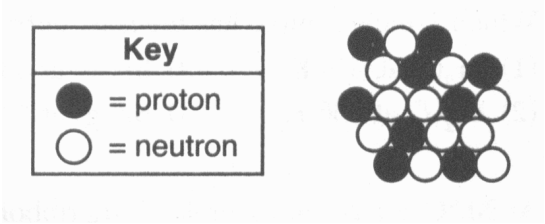
1. The diagram below represents the nucleus of an atom.



What are the atomic number and mass number of this atom?

A) The atomic number is 9 and the mass number is 19.
B) The atomic number is 9 and the mass number is 20.
C) The atomic number is 11 and the mass number is 19.
D) The atomic number is 11 and the mass number is 20.

2. Which statement concerning elements is true?

A) Different elements must have different numbers of isotopes.
B) Different elements must have different numbers of neutrons.
C) All atoms of a given element must have the same mass number.
D) All atoms of a given element must have the same atomic number.

3. Which subatomic particles are located in the nucleus of an He-4 atom?

A) electrons and neutrons
B) electrons and protons
C) neutrons and protons
D) neutrons, protons, and electrons

4. Which part of a helium atom is positively charged?

A) electron B) neutron
C) nucleus D) orbital

5. Which total mass is the *smallest*?

A) the mass of 2 electrons
B) the mass of 2 neutrons
C) the mass of 1 electron plus the mass of 1 proton
D) the mass of 1 neutron plus the mass of 1 electron

6. Subatomic particles can usually pass undeflected through an atom because the volume of an atom is composed of

A) an uncharged nucleus
B) largely empty space
C) neutrons
D) protons

7. An experiment in which alpha particles were used to bombard thin sheets of gold foil led to the conclusion that an atom is composed mostly of

A) empty space and has a small, negatively charged nucleus
B) empty space and has a small, positively charged nucleus
C) a large, dense, positively charged nucleus
D) a large, dense, negatively charged nucleus

8. Which conclusion is based on the "gold foil experiment" and the resulting model of the atom?

A) An atom is mainly empty space, and the nucleus has a positive charge.
B) An atom is mainly empty space, and the nucleus has a negative charge.
C) An atom has hardly any empty space, and the nucleus has a positive charge.
D) An atom has hardly any empty space, and the nucleus has a negative charge.

9. Which statement about the mass of an electron is correct?

A) The mass of an electron is equal to the mass of a proton.
B) The mass of an electron is less than the mass of a proton.
C) The mass of an electron is equal to the mass of a neutron.
D) The mass of an electron is greater than the mass of a neutron.

10. Experiments with gold foil indicated that atoms

A) usually have a uniform distribution of positive charges
B) usually have a uniform distribution of negative charges
C) contain a positively charged, dense center
D) contain a negatively charged, dense center

11. Two atoms will always have the same atomic number if they have the same

A) mass number **B) number of protons**
C) number of neutrons D) number of nucleons

12. A sample composed only of atoms having the same atomic number is classified as

A) a compound B) a solution
C) a element D) an isomer

13. What can be determined if only the atomic number of an atom is known?

A) the total number of neutrons in the atom, only
B) the total number of protons in the atom, only
C) the total number of protons and the total number of neutrons in the atom
D) the total number of protons and the total number of electrons in the atom

14. Which two particles make up most of the mass of a hydrogen-2 atom?

A) electron and neutron
B) electron and proton
C) proton and neutron
D) proton and positron

15. Which particle has a mass that is approximately the same as the mass of a proton?

A) an alpha particle B) a beta particle
C) a neutron D) a positron

16. The total mass of the protons in an atom of gold-198 is approximately

A) 79 atomic mass units
B) 119 atomic mass units
C) 198 atomic mass units
D) 277 atomic mass units

17. The atomic mass unit is defined as exactly 1/12 the mass of an atom of

A) $^{12}_{6}C$ B) $^{14}_{6}C$
C) $^{24}_{12}Mg$ D) $^{26}_{12}Mg$

18. The table below indicates the stability of six nuclides.

Stability of Six Nuclides

Nuclide	Stability
C-12	stable
C-14	unstable
N-14	stable
N-16	unstable
O-16	stable
O-19	unstable

All atoms of the unstable nuclides listed in this table have

A) an odd number of neutrons
B) an odd number of protons
C) more neutrons than protons
D) more protons than neutrons

19. The table below gives information about the nucleus of each of four atoms.

Nuclei of Four Atoms

Atom	Number of Protons	Number of Neutrons
A	6	6
D	6	7
E	7	7
G	7	8

How many different elements are represented by the nuclei in the table?

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

20. Which atoms represent different isotopes of the same element?

A) $^{12}_{6}C$ and $^{12}_{7}C$ B) $^{14}_{7}N$ and $^{14}_{7}N$
C) $^{15}_{8}O$ and $^{16}_{8}O$ D) $^{19}_{9}F$ and $^{9}_{19}F$

21. In which two atoms do both nuclides contain the same number of neutrons?

A) $^{20}_{10}Ne$ and $^{40}_{18}Ar$ B) $^{65}_{29}Cu$ and $^{65}_{30}Zn$
C) $^{24}_{12}Mg$ and $^{26}_{12}Mg$ **D) $^{14}_{6}C$ and $^{16}_{8}O$**

22. Hydrogen has three isotopes with mass numbers of 1, 2, and 3 and has an average atomic mass of 1.00794 amu. This information indicates that

A) equal numbers of each isotope are present
B) more isotopes have an atomic mass of 2 or 3 than of 1
C) more isotopes have an atomic mass of 1 than of 2 or 3
D) isotopes have only an atomic mass of 1

23. If 75.0% of the isotopes of an element have a mass of 35.0 amu and 25.0% of the isotopes have a mass of 37.0 amu, what is the atomic mass of the element?

A) 35.0 amu B) 36.0 amu
C) 35.5 amu D) 37.0 amu

24. The electron configuration of an atom in the ground state is 2-4. The total number of occupied principal energy levels in this atom is

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

25. How do the energy and the most probable location of an electron in the third shell of an atom compare to the energy and the most probable location of an electron in the first shell of the same atom?

A) In the third shell, an electron has more energy and is closer to the nucleus.
B) In the third shell, an electron has more energy and is farther from the nucleus.
C) In the third shell, an electron has less energy and is closer to the nucleus.
D) In the third shell, an electron has less energy and is farther from the nucleus.

26. What is the maximum number of electrons that may be present in the second principal energy level of an atom?

A) 8 B) 2 C) 18 D) 32

27. Which statement describes how an atom in the ground state becomes excited?

A) The atom absorbs energy, and one or more electrons move to a higher electron shell.
B) The atom absorbs energy, and one or more electrons move to a lower electron shell.
C) The atom releases energy, and one or more electrons move to a higher electron shell.
D) The atom releases energy, and one or more electrons move to a lower electron shell.

28. Which Group 18 element in the ground state has a maximum of 2 completely filled energy shells?

A) Kr B) Xe C) He **D) Ne**

29. Which electron configuration represents an atom of chlorine in an excited state?

A) 2–8–7 B) 2–8–8
C) 2–8–6–1 D) 2–8–7–1

30. Which group of atomic models is listed in historical order from the earliest to the most recent?

A) hard-sphere model, wave-mechanical model, electron-shell model
B) hard-sphere model, electron-shell model, wave-mechanical model
C) electron-shell model, wave-mechanical model, hard-sphere model
D) electron-shell model, hard-sphere model, wave-mechanical model

31. Bromine has chemical properties most similar to

A) fluorine B) potassium
C) krypton D) mercury

32. The properties of elements are periodic functions of their

A) mass numbers B) atomic masses
C) atomic radii **D) atomic numbers**

33. Elements on the modern Periodic Table are arranged in order of increasing

A) atomic mass
B) atomic number
C) number of neutrons
D) number of valence electrons

34. 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 B) 2 C) 15 **D) 16**

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

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

36. Which substance is the best conductor of electricity?

A) nitrogen B) neon
C) sulfur **D) silver**

37. Which element has the highest melting point?

A) tantalum **B) rhenium**
C) osmium D) hafnium

38. Which two characteristics are associated with metals?

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

39. Which is a property of most nonmetallic solids?

A) high thermal conductivity
B) high electrical conductivity
C) brittleness
D) malleability

40. Which element is a liquid at STP and has low electrical conductivity?

A) silver B) mercury
C) barium **D) bromine**

41. Which element can be brittle or soft in the solid phase and is a *poor* conductor of heat and electricity?

A) calcium **B) sulfur**
C) strontium D) copper

42. Which group in the Periodic Table contains elements that are all monatomic gases at STP?

A) 15 B) 16 C) 17 **D) 18**

43. 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

44. The element arsenic (As) has the properties of

A) metals, only
B) nonmetals, only
C) both metals and nonmetals
D) neither metals nor nonmetals

45. Which is an example of a metalloid?

A) sodium B) strontium
C) silicon D) sulfur

46. At standard pressure, which element has a melting point higher than standard temperature?

A) F_2 B) Br_2 **C) Fe** D) Hg

47. Which element has the greatest density at STP?

A) barium B) beryllium
C) magnesium **D) radium**

48. Which element in Group 18 is naturally radioactive and has no stable isotopes?

A) Ar B) Kr C) Xe **D) Rn**

49. Which element is a metal that is in the liquid phase at STP?

A) bromine B) cobalt
C) hydrogen **D) mercury**

50. Which Group 15 element exists as diatomic molecules at STP?

A) phosphorus **B) nitrogen**
C) bismuth D) arsenic

51. At 298 K, oxygen (O_2) and ozone (O_3) have different properties because their

A) atoms have different atomic numbers
B) atoms have different atomic masses
C) molecules have different molecular structures
D) molecules have different average kinetic energies

52. Which element has the greatest density at STP?

A) calcium B) carbon
C) chlorine **D) copper**

53. A 10.0-gram sample of which element has the *smallest* volume at STP?

A) aluminum B) magnesium
C) titanium **D) zinc**

54. Which gaseous element has the greatest density at STP?

A) N_2 B) O_2 **C) Cl_2** D) F_2

55. What is the density of N_2 at STP?

A) .00100 g/cm^3 **B) .00125 g/cm^3**
C) .00143 g/cm^3 D) .00198 g/cm^3

56. Which Lewis electron-dot diagram represents an atom in the ground state for a Group 13 element?

A)  B) **C)**  D) 

57. Which is the electron-dot symbol for an atom with an electron configuration of 2-5?

A)  **B)**  C)  D) 

58. Compared to the valence electrons of a nonmetallic atom, the valence electrons of a metallic atom are generally

A) fewer in number and less strongly held
B) fewer in number and more strongly held
C) greater in number and less strongly held
D) greater in number and more strongly held

59. Which is the electron configuration of a neutral atom in the ground state with a total of six valence electrons?

A) 2-4 **B) 2-6** C) 2-8 D) 2-8-8

60. Which is the atomic number of an atom with six valence electrons?

A) 6 **B) 8** C) 10 D) 12

61. Which element can react with fluorine to form more than one binary compound?

A) K B) Mg **C) Co** D) Na

62. Which metal atoms can form ionic bonds by losing electrons from both the outermost and next to outermost principal energy levels?

A) Fe B) Pb C) Mg D) Ca

63. Which changes occur as a cadmium atom, Cd, becomes a cadmium ion, Cd^{2+}?

A) The Cd atom gains two electrons and its radius decreases.
B) The Cd atom gains two electrons and its radius increases.
C) The Cd atom loses two electrons and its radius decreases.
D) The Cd atom loses two electrons and its radius increases.

64. Which species has the same electron configuration as a Cl^- ion?

A) S **B) Ar** C) Br^- D) F^-

65. Which electron configuration represents the atom with the largest atomic radius?

A) 1 **B) 2-1** C) 2-2 D) 2-3

66. As the elements of Group 17 are considered in order of increasing atomic number, there is an increase in

A) atomic radius
B) electronegativity
C) first ionization energy
D) number of electrons in the first shell

67. Which of the following ions has the *smallest* radius?

A) F^- B) Cl^- C) K^+ D) Ca^{2+}

68. Which element's ionic radius is smaller than its atomic radius?

A) neon B) nitrogen
C) sodium D) sulfur

69. Of all the elements, the one with the highest electronegativity is found in Period

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

70. As atoms of elements in Group 16 are considered in order from top to bottom, the electronegativity of each successive element

A) decreases B) increases
C) remains the same

71. Which sequence correctly places the elements in order of increasing ionization energy?

A) H → Li → Na → K
B) I → Br → Cl → F
C) O → S → Se → Te
D) H → Be → Al → Ga

72. 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

73. Which nonmetal is the most reactive?

A) fluorine B) chlorine
C) bromine D) iodine

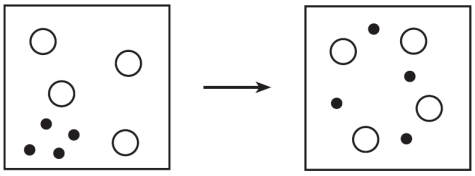
74. Which of the following Group 15 elements has the most metallic properties?

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

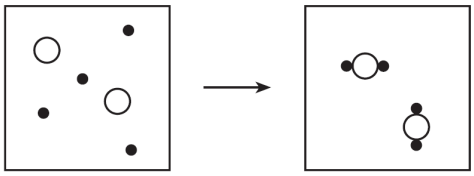
75. Which diagram represents a physical change, only?

Key
• = an atom of an element
○ = an atom of a different element

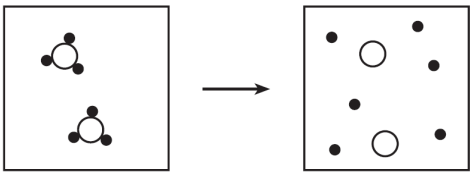
A)



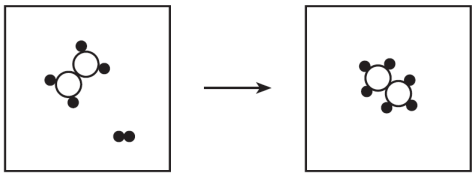
B)



C)



D)



76. Two categories of compounds are

A) covalent and molecular
B) covalent and metallic
C) ionic and molecular
D) ionic and metallic

77. Which substance can be broken down by chemical means?

A) magnesium
B) manganese
C) mercury
D) methanol

78. Which formula represents strontium phosphate?

A) $SrPO_4$
B) Sr_3PO_8
C) $Sr_2(PO_4)_3$
D) $Sr_3(PO_4)_2$

79. Which is the formula for the compound that forms when magnesium bonds with phosphorus?

A) Mg_2P
B) MgP_2
C) Mg_2P_3
D) Mg_3P_2

80. Which formula represents a binary compound?

A) Ne
B) Br_2
C) C_3H_8
D) H_2SO_4

81. What is the IUPAC name for the compound ZnO?

A) zinc oxide
B) zinc oxalate
C) zinc peroxide
D) zinc hydroxide

82. Base your answer to the following question on Copper has two naturally occurring isotopes. Information about the two isotopes is shown in the table below.

Naturally Occurring Isotopes of Copper

Isotope	Atomic Mass (atomic mass units, u)	Percent Natural Abundance (%)
Cu-63	62.93	69.17
Cu-65	64.93	30.83

In the space *in your answer booklet*, show a numerical setup for calculating the atomic mass of copper.

83. Base your answer to the following question on the information below

An atom in an excited state has an electron configuration of 2-7-2.

Write the electron configuration of this atom in the ground state.

84. Describe the electrons in an atom of carbon in the ground state. Your response must include:

- the charge of an electron
- the location of electrons based on the wave-mechanical model
- the total number of electrons in a carbon atom

85. Base your answer to the following question on the information below.

The atomic radius and the ionic radius for some Group 1 and some Group 17 elements are given in the tables below.

Atomic and Ionic Radii of Some Elements

Group 1

Particle	Radius (pm)
Li atom	130.
Li^+ ion	78
Na atom	160.
Na^+ ion	98
K atom	200.
K^+ ion	133
Rb atom	215
Rb^+ ion	148

Group 17

Particle	Radius (pm)
F atom	60.
F^- ion	133
Cl atom	100.
Cl^- ion	181
Br atom	117
Br^- ion	?
I atom	136
I^- ion	220.

State the relationship between atomic number and first ionization energy as the elements in Group 1 are considered in order of increasing atomic number.

86. Base your answer to the following question on the information below.

Densities of Group 14 Elements

Element	Density at STP (g/cm^3)
C	3.51
Si	2.33
Ge	5.32
Sn	7.31
Pb	11.35

Calculate the volume of a tin block that has a mass of 95.04 grams at STP. Your response must include *both* a numerical setup and the calculated result

87. Explain, in terms of atomic structure, why the atomic radius of iodine is greater than the atomic radius of fluorine.

88. Base your answer to the following question on the information below.

A metal, *M*, was obtained from a compound in a rock sample. Experiments have determined that the element is a member of Group 2 on the Periodic Table of the Elements.

What is the phase of element *M* at STP?

89. 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_2O_3. On the modern Periodic Table, what is the group number and period number of element *X*?

90. Fluorine is a Group 17 element. Fluorine is the most electronegative and reactive of all elements. It is a pale yellow, corrosive gas, which reacts with practically all organic and inorganic substances.

a Draw the Lewis electron-dot structure for an *atom* of fluorine.

b What is the definition (or your interpretation} of the term "electronegativity".

c Explain why the electronegativity of elements in Group 17 decreases as you go down within that group.

Answer Key
Regents review Atomic and Periodic 2011-2012

1. **B**
2. **D**
3. **C**
4. **C**
5. **A**
6. **B**
7. **B**
8. **A**
9. **B**
10. **C**
11. **B**
12. **C**
13. **D**
14. **C**
15. **C**
16. **A**
17. **A**
18. **C**
19. **B**
20. **C**
21. **D**
22. **C**
23. **C**
24. **B**
25. **B**
26. **A**
27. **A**
28. **D**
29. **C**
30. **B**
31. **A**
32. **D**
33. **B**
34. **D**
35. **C**
36. **D**
37. **B**
38. **A**
39. **C**
40. **D**
41. **B**
42. **D**
43. **D**
44. **C**
45. **C**
46. **C**
47. **D**
48. **D**
49. **D**
50. **B**
51. **C**
52. **D**
53. **D**
54. **C**
55. **B**
56. **C**
57. **B**
58. **A**
59. **B**
60. **B**
61. **C**
62. **A**
63. **C**
64. **B**
65. **B**
66. **A**
67. **A**
68. **C**
69. **B**
70. **A**
71. **B**
72. **B**
73. **A**
74. **A**
75. **A**
76. **C**
77. **D**
78. **D**
79. **D**
80. **C**
81. **A**
82. Acceptable responses include, but are not limited to: • (62.93 u)(0.6917) + (64.93 u)(0.3083) or $\frac{(62.93)(69.17)+(64.93)(30.83)}{100}$
83. 2-8-1
84. Answer: • an electron has a negative charge. • electrons are located in orbitals or regions of most probable location. • a carbon atom has six electrons.
85. —As the elements in Group 1 are considered in order of increasing atomic number, first ionization energy decreases. —As atomic number increases, first ionization energy decreases.
86. 7.31 g/cm^3 = $\frac{95.04g}{V}$
87. Examples: – An iodine aton has more electron shells than a fluorine atom. – A fluorine atom has fewer electron shells.
88. solid
89. Group 13 and Period 4
90.