Chapter 5 (Models of the Atom) Bookwork Answer Key

1, 3, 6, 9, 13, 14, 21, 23, 29, 34, 37, 39, 43, 49, 55, 59, 64, 69, 73, 77, 80, 81, 85, 89, 92, 98

1. (c) Atoms are indivisible later proved to be invalid with Thomson's discovery of the electron and proton.

3. Dalton relied on the work of (1) *Robert Boyle,* who first proposed the particle nature of gases; (2) *Antoine Lavoisier,* who established the law of conservation of mass; and (3) *Joseph Proust,* who established the law of definite composition.

6. The proton (p^+) is the simplest positive particle.

9. Raisins in plum pudding are analogous to electrons in atoms.

13. The relative charge of an electron and proton is –1 and +1, respectively.

14. The relative mass of an electron to a proton is 1/1836.

21.

Atomic Notation	Atomic Number	Mass Number	Number of Protons	Number of Neutrons	Number of Electrons
$^{11}_{5}B$	5	11	5	6	5
$^{15}_{7}N$	7	15	7	8	7
$^{40}_{20}Ca$	20	40	20	20	20
$^{200}_{80}Hg$	80	200	80	120	80

23.

(a) $4\,n^0$ $3\,p^+$ — 3 e–

(b) $7\,n^0$ $6\,p^+$ — 6 e–

(c) $8\,n^0$ $8\,p^+$ — 8 e–

(d) $10\,n^0$ $10\,p^+$ — 10 e–

29. ^{23}Na has only one naturally occurring isotope with a mass of 22.99 amu.

34.

Mg-24:	23.985 amu × 0.7870	=	18.88 amu
Mg-25:	24.986 amu × 0.1013	=	2.531 amu
Mg-26:	25.983 amu × 0.1117	=	2.902 amu
	Atomic Mass	=	24.31 amu

37. If the average mass of bromine is approximately 80 amu, and one isotope is Br-79, the other isotope must be Br-81.

39. Violet light has a shorter wavelength than blue light.

43. Violet light has higher energy than blue light.

49.

Example	Spectrum
(a) rainbow	continuous
(b) line spectrum	quantized

55. The transition from energy level 5 to 2 is the most energetic because the electron drops from a higher energy level than 4 to 2, or 3 to 2.

59.

Energy Level Change	Type of Emission
5 to 1	ultraviolet energy

64.

Energy Level Change	Number of Photons
(a) 3 to 2	100
(b) 4 to 2	100

69.

Energy Level	Number of Sublevels
(a) first level	1 sublevel
(b) second level	2 sublevels
(c) third level	3 sublevels
(d) fourth level	4 sublevels

73. The maximum number of electrons in the second energy level is equal to the sum of the maximum number of electrons in the 2*s* and 2*p* sublevels, that is, $2\ e^- + 6\ e^- = 8\ e^-$.

77.

Element	Electron Configuration
(a) He	$1s^2$
(b) Be	$1s^2\ 2s^2$
(c) Co	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^7$
(d) Cd	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}$

80.

	Electron Configuration	Element
(a)	$1s^2\ 2s^2 2p^5$	F
(b)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$	Ar
(c)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^5$	Tc
(d)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^{10}\ 4p^6\ 5s^2\ 4d^{10}\ 5p^5$	I

81. An orbit is the path traveled by an electron of given energy about the nucleus of an atom, according to the Bohr model.

85.

	Orbitals	Higher Energy		Orbitals	Higher Energy
(a)	2*s* or 3*s*	3*s*	(b)	$2p_x$ or $3p_x$	$3p_x$
(c)	$2p_x$ or $2p_y$	both are equal	(d)	$4p_y$ or $4p_z$	both are equal

89.

	Orbital	Max. # of Electrons
(a)	1*s* orbital	2 e^-
(b)	2*p* orbital	2 e^-
(c)	3*d* orbital	2 e^-
(d)	4*f* orbital	2 e^-

92. $$1.60 \times 10^{-19}\ \cancel{\text{coulomb}} \times \frac{1\ \text{g}}{9.57 \circ 10^{4}\ \cancel{\text{coulomb}}} = 1.67 \times 10^{-24}\ \text{g}$$

98. The higher frequency has the most energy because frequency and energy are directly related. The frequency with the higher energy is 5×10^{11} cycles/s.