

Key - H. Chemistry Unit 1 Test Study Guide Key

(1)

1. a. 102.109 - 5 sf
- b. 0.046000 cm - 5 sf leading zeroes are never significant
- c. 5.78×10^4 mg - 3 sf
- d. 100 km/hr - 1 sf no decimal point so the trailing zeroes aren't significant
- e. 100. km/hr - 3 sf there's a decimal point so these zeroes count

2. a. $2.\underline{2}3\text{g} + 8.\underline{3}\text{g} = 10.53\text{g}$ → 10.5 g
 2sf 1sf only 1 sf after the decimal

b. $\underline{1.000}5\text{m} \times 0.0\underline{560}0\text{m} = 0.056028\text{ m}^2$ → 0.0560 m²
 5sf 3sf only 3 sf total

c. $48.\underline{12}0\text{miles} - 40.\underline{17}854\text{miles} = 27.3346\text{ miles}$ → 27.335 miles
 3sf 5sf only 3 sf after the decimal

d. $\frac{(3.0 \times 10^8 \text{ m/s})}{(1.50 \times 10^{-7} \text{ m})} = 2 \times 10^{15} \text{ 1/s}$ → $2.0 \times 10^{15} \text{ 1/s}$
 2sf 3sf only 2 sf total

3. a. Democritus - 1st person to develop the idea that all matter is made of tiny, indivisible particles, called atoms

b. John Dalton - Dalton's Atomic Theory states:

- 1.) Elements are composed of tiny, indivisible particles called atoms
- 2.) All atoms of a given element are identical
- 3.) Atoms of one element are different from atoms of another element
- 4.) Atoms combine in simple, whole-number ratios to form compounds
- 5.) Atoms are not created or destroyed, only rearranged in chemical reactions

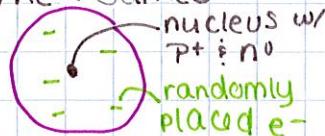
c. JJ Thomson - conducted the cathode ray experiment to show that there are tiny, negatively charged particles inside the atom, called electrons.

Plum Pudding Model

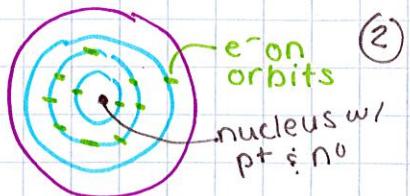


d. Ernest Rutherford - conducted the gold foil experiment to show that the positive charge in an atom is concentrated in a tiny nucleus in the center of the atom. He later discovered that the positive charge comes from protons in the nucleus. Later still, he & James Chadwick discovered neutrons in the nucleus too.

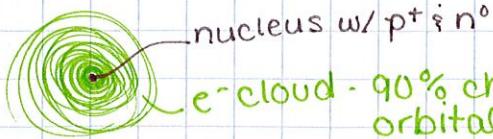
Rutherford's model of the atom →



e. Neils Bohr Planetary model of the atom



f. Erwin Schrödinger, Neils Bohr, & Werner Heisenberg Quantum Mechanical model of the atom



e^- -cloud - 90% chance of finding an e^- in an orbital w/i the cloud.

4. a. protons (p^+) - positively charged particles in the nucleus of an atom
neutrons (n^0) - neutrally charged particles in the nucleus of an atom
electrons (e^-) - negatively charged particles in the electron cloud

- b. atomic number - # p^+ in the nucleus (also the # e^-)
mass number - # p^+ and # n^0 in the nucleus

- c. isotope - atoms of an element w/ different # n^0 in the nucleus
d. skip this one!

e.

Name	Symbol	Atomic #	Mass #	# p^+	# e^-	# n^0	Isotopic Symbol
beryllium	Be	4	9	4	4	$9-4=5$	${}^9_4 \text{Be}$
manganese	Mn	25	56	25	25	$56-25=31$	${}^{56}_{25} \text{Mn}$
cadmium	Cd	48	${}^{48+62}_{\text{Cd}} = 110$	48	48	62	${}^{110}_{48} \text{Cd}$
arsenic	As	33	75	33	33	$75-33=42$	${}^{75}_{33} \text{As}$

f. A.M. = $(23.98504 \text{amu} \cdot .7870) + (24.98584 \text{amu} \cdot .1013)$
 $+ (25.98259 \text{amu} \cdot .1117)$

A.M. = 24.30954738amu \rightarrow 24.31 amu

5. a. O : has 8 e^- $1s^2 2s^2 2p^4$ or $[\text{He}] 2s^2 2p^4$
b. Mo : has 42 e^- $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^4$ or $[\text{Kr}] 5s^2 4d^4$
c. As : has 33 e^- $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^3$ or $[\text{Ar}] 4s^2 3d^{10} 4p^3$
d. Tc : has 43 e^- $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 3d^{10} 4p^6 5s^2 4d^5$ or $[\text{Kr}] 5s^2 4d^5$

6. a. when elements are heated, the electrons in the atoms absorb energy and move to a higher orbital, called getting excited. The electrons are unstable and release the extra energy as photons of colored light with a frequency we can see and they move back down to their original, ground state orbital.

(3)

Q.b. i. $c = 3.00 \times 10^8 \text{ m/s}$
 $\lambda = 6.76 \times 10^{-7} \text{ m}$
 $\nu = ?$

$$\nu = \frac{c}{\lambda}$$

$$\nu = \frac{3.00 \times 10^8 \text{ m/s}}{6.76 \times 10^{-7} \text{ m}}$$

$$\boxed{\nu = 4.44 \times 10^{14} \text{ Hz}}$$



$$c = \lambda \cdot \nu$$

$E = ?$
 $h = 6.626 \times 10^{-34} \text{ J.s}$
 $\nu = 4.44 \times 10^{14} \text{ Hz}$

$$E = h \cdot \nu$$

$$E = (6.626 \times 10^{-34} \text{ J.s})(4.44 \times 10^{14} \text{ Hz})$$

$$\boxed{E = 2.94 \times 10^{-19} \text{ J}}$$

ii. $c = 3.00 \times 10^8 \text{ m/s}$
 $\lambda = ?$
 $\nu = 5.30 \times 10^{14} \text{ Hz}$

$$\lambda = \frac{c}{\nu}$$

$$\lambda = \frac{3.00 \times 10^8 \text{ m/s}}{5.30 \times 10^{14} \text{ Hz}}$$

$$\boxed{\lambda = 5.66 \times 10^{-7} \text{ m}}$$

iii. $c = 3.00 \times 10^8 \text{ m/s}$
 $\lambda = 4.93 \times 10^{-7} \text{ m}$
 $\nu = ?$

$$\nu = \frac{c}{\lambda}$$

$$\nu = \frac{3.00 \times 10^8 \text{ m/s}}{4.93 \times 10^{-7} \text{ m}}$$

$$\boxed{\nu = 6.09 \times 10^{14} \text{ Hz}}$$

$E = ?$
 $h = 6.626 \times 10^{-34} \text{ J.s}$
 $\nu = 6.09 \times 10^{14} \text{ Hz}$

$$E = h \cdot \nu$$

$$E = (6.626 \times 10^{-34} \text{ J.s})(6.09 \times 10^{14} \text{ Hz})$$

$$\boxed{E = 4.04 \times 10^{-19} \text{ J}}$$

iv. $c = 3.00 \times 10^8 \text{ m/s}$
 $\lambda = ?$
 $\nu = 7.12 \times 10^{14} \text{ Hz}$

$$\lambda = \frac{c}{\nu}$$

$$\lambda = \frac{3.00 \times 10^8 \text{ m/s}}{7.12 \times 10^{14} \text{ Hz}}$$

$$\boxed{\lambda = 4.21 \times 10^{-7} \text{ m}}$$

$E = ?$
 $h = 6.626 \times 10^{-34} \text{ J.s}$
 $\nu = 7.12 \times 10^{14} \text{ Hz}$

$$E = h \cdot \nu$$

$$E = (6.626 \times 10^{-34} \text{ J.s})(7.12 \times 10^{14} \text{ Hz})$$

$$\boxed{E = 4.72 \times 10^{-19} \text{ J}}$$

7. All elements from hydrogen through iron formed in stars by fusion. Elements heavier than iron formed when stars explode in a supernova by fusion.

(4)

A hand-drawn periodic table on lined paper. The first two columns (Groups 1 and 2) are highlighted with blue boxes. Groups 13 through 18 are highlighted with yellow boxes. The entire row of noble gases (He, Ne, Ar, Kr, Xe, Rn) is highlighted with a thick yellow border. The table shows atomic number 1 at the top left and continues to 18 across the bottom.



8. group - vertical column on the P.T.

9. period - horizontal row on the P.T.

10 metals -

nonmetals -

metalloids -

11. a. transition metals

d. halogens

b. noble gases

e. alkaline earth metals

c. inner transition metal

f. alkali metals



12. The P.T. is arranged in order of increasing atomic number

13.

	atomic radius	ionization energy	electro-negativity
down a group	increase	decrease	decrease
across a period	decrease	increase	increase

14 a. Cr has a larger radius than Cu.

b. Cr has a larger ionization energy than Cu.

c. i. Si \rightarrow Pb \rightarrow Fl

ii. Sb \rightarrow Ag \rightarrow Mo

d. i. Si \rightarrow Pb \rightarrow Fl

ii. Sb \rightarrow Ag \rightarrow Mo

e. i. Fl \rightarrow Pb \rightarrow Si

ii. Mo \rightarrow Ag \rightarrow Sb