

General Chemistry – Semester 1 Review Key

1. Devise an experiment to test your hypothesis.
2. **Element:** A substance that can't be separated into simpler substances by chemical means. A single type of atom.

Compound: A substance composed of atoms of two or more different elements chemically united (bonded) in fixed proportions.

Mixture: A combination of two or more substances in which the substances retain their identities. They can be separated by physical means and do not combine in specific ratios.

3. **Chemical Change:** A change in which the chemical identity of a substance is altered through a chemical reaction.

Physical Change: A change to a substance in which its chemical properties are retained (such as a change of state).

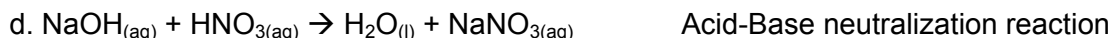
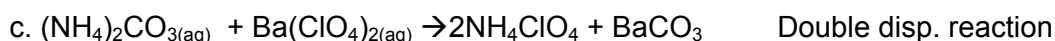
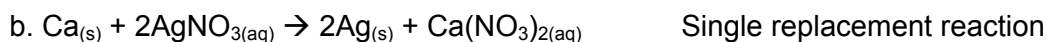
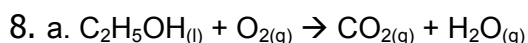
4. Precision is how well experimental results agree with one another. Accuracy is how well experimental results agree with accepted, published values. The student's results would be considered precise but not accurate based on the definition given above.

5. a. Fe_2O_3 b. SnS_2 c. As_4O_{10} d. H_2SO_4 e. CuSO_4 f. N_2O_5

6. a. barium sulfate b. tetraiodine nonoxide c. potassium phosphate

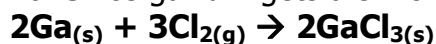
d. ammonium acetate e. iron(III)carbonate (or ferric carbonate) f. nitrous acid

$$7. 79.90 = (78.9183)(.5069) + (x)(.4931)$$
$$.4931x = 39.8963 \quad x = 80.909 = \mathbf{80.91\text{amu} = \text{Br-81}}$$



9. From the solubility rules, it is predicted that BaCO_3 (barium carbonate) will be the insoluble product.

10. Since gallium gets a 3+ charge and chloride is a 1- charge the balanced equation is:



11. a. heterogeneous mixture (contains various compounds in nonspecific ratios. Difference in types of particles is distinguishable)

- b. Element and molecule
 c. Compound (not a molecule because it is an ionic compound. Molecules must have covalent bonds as in nonmetal-nonmetal bonds)
 d. Homogeneous mixture (uniform mixture of acetic acid, water and various other soluble compounds)
 e. Compound and molecule f. Compound and molecule

12. Density = mass / volume

$$\text{Density} = 9.55 \text{ g} / (2.00\text{cm} \times 1.50\text{cm} \times 1.50\text{cm}) = \mathbf{2.12 \text{ g/cm}^3}$$

$$2.12 \text{ g/cm}^3 (1\text{kg} / 1,000\text{g})(1,000 \text{ cm}^3 / 1 \text{ dm}^3) = \mathbf{2.12 \text{ kg/dm}^3}$$

$$13. 2.00^\circ\text{F} \quad ^\circ\text{C} = (5/9) ^\circ\text{F} = (5/9) 2.00 = 1.11^\circ\text{C}$$

$$\text{Final temperature} = 25.0 - 1.11 = \mathbf{23.9^\circ\text{C}}$$

$$14. q = mc\Delta T \quad 60.\text{J} = (5.0\text{g})(c)(4.0^\circ\text{C})$$

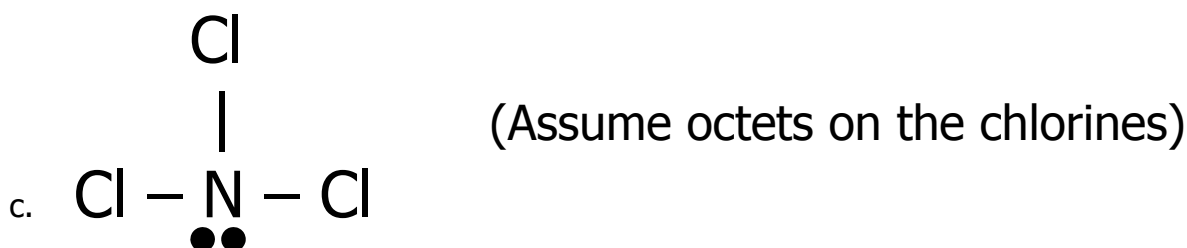
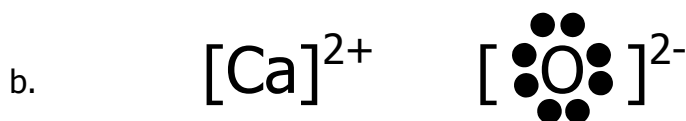
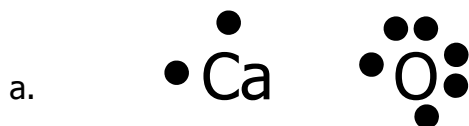
$$c = 60.\text{J} / [(5.0\text{g})(4.0^\circ\text{C})] = \mathbf{3.0 \text{ J/g}^\circ\text{C}}$$

15. Fill in the missing information in the chart:

Element	Protons	Neutrons	Electrons (in neutral atom)	Group number (and name if applicable)	Common charge	Spectroscopic notation (for neutral atom).
Potassium	19	20	19	IA, alkali metal	1+	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
Calcium	20	20	20	IIA, Alkaline earth metal	2+	$1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$
Chlorine	17	18	17	VIIA, halogen	1-	$1s^2 2s^2 2p^6 3s^2 3p^5$
Silicon	14	14	14	IVA		$1s^2 2s^2 2p^6 3s^2 3p^2$
Neon	10	10	10	VIIIA, Noble gas	0	$1s^2 2s^2 2p^6$

16. Potassium; metal; 1 calcium; metal; 2 chlorine; nonmetal; 7
 silicon; metalloid; 4 neon; nonmetal; 8

17.



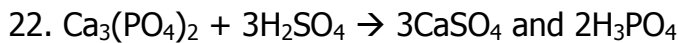
18. Primarily the plum pudding model did not account for the nucleus of the atom. In addition, neutrons and quantized orbits had not been established. The Rutherford Gold Foil experiment resulted in the discovery of the nucleus of the atom.

$$19. \nu = c / \lambda \quad \nu = (3.00 \times 10^8 \text{ m/s}) / (3.25 \times 10^{-7} \text{ m}) = \mathbf{9.23 \times 10^{14} \text{ Hz.}}$$

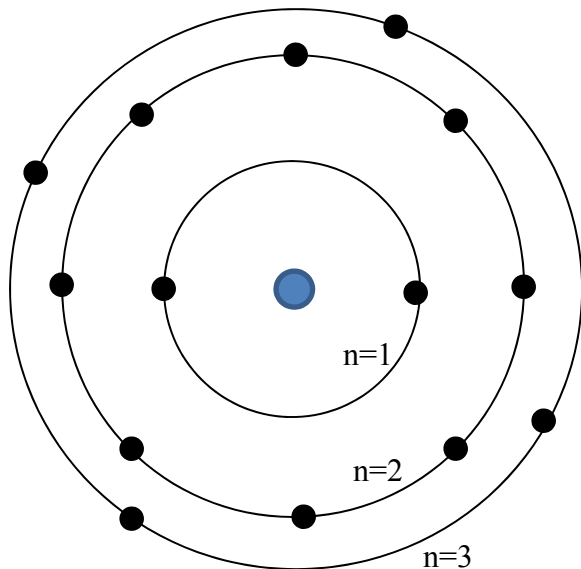
$$E = h\nu = (6.62 \times 10^{-34} \text{ Js})(9.23 \times 10^{14} \text{ Hz}) = \mathbf{6.12 \times 10^{-19} \text{ J}}$$

20. The compound is nitrogen trichloride. The central nitrogen has four electron pairs around it. Three are bonding and one is a lone pair. Therefore the **electronic geometry** is **tetrahedral** and the **molecular geometry** is **trigonal pyramidal**.

21. Carbon-12 has a mass of exactly 12amu so the sulfur isotope would be $(12)(2.6643) = \mathbf{31.9716 \text{ amu}}$ (sulfur-32). Since all sulfur atoms have 16 protons, there would be **16 neutrons** in sulfur-32.



23.



24. a) In the third principle energy level there is a s, p and d sublevel the electrons for each level are 2, 6 and 10 respectively for a total of **18 electrons**. b) Any d-sublevel has five orbitals each of which can contain 2 electrons for a total of **10 electrons**. c) Any single orbital regardless of the energy level can have a maximum of **2 electrons**.

25. The energy difference between the levels is equal to the energy of the photon emitted (conservation of energy). The energy of the photon is $E = h\nu = (6.626 \times 10^{-34} \text{ Js})(6.91 \times 10^{14} \text{ Hz}) = \mathbf{4.58 \times 10^{-19} \text{ J}}$

26. Atomic radius increases to the left and down. Therefore;
N < P < Ga < Ca < Rb