

Chemistry 1035 – Exam #1 – Form A

February 12, 2004

Name: _____ KEY _____

Student Number: _____

The Virginia Tech Honor Code

The Honor Code will be strictly enforced in this course. All assignments submitted shall be considered graded work, unless otherwise noted. All aspects of your coursework are covered by the Honor System. Any suspected violations of the Honor Code will be promptly reported to the Honor System. Honesty in your academic work will develop into professional integrity. The faculty and students of Virginia Tech will not tolerate any form of academic dishonesty.

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1. In the scientific method, a hypothesis is all of the following except:
 - a. A proposal to explain observations
 - b. Always correct
 - c. Testable

2. Which of the following is an example of a change in a Chemical Property?
 - a. The iron in discarded automobiles slowly forms a reddish brown, crumbly rust.
 - b. A magnet separates a mixture of black iron shavings from white sand
 - c. Water boiling
 - d. Sugar dissolving in water

3. A liquid is a state of matter defined as:
 - a. A substance that has fixed volume and fixed shape
 - b. A substance that has fixed volume but takes the shape of its container
 - c. A substance that takes the volume and shape of its container.
 - d. All of these.

4. What is the length in Inches of a 100.0 meter soccer pitch (field)? (1inch=2.54cm)
 - a. 25400 inches
 - b. 254 inches
 - c. 39.37 inches
 - d. 3937 inches

$$100.0m \times \frac{100cm}{1m} \times \frac{1inch}{2.54cm} = 3937inch$$

5. The speed of light in a vacuum is 2.998×10^8 meters/second. What is the speed of light in miles/minute? (1 mile = 1609 meters)
 - a. 1.118×10^7 mile/minute
 - b. 8.040×10^9 mile/minute
 - c. 3.105×10^3 mile/minute
 - d. 2.984×10^{13} mile/minute

$$\frac{2.998 \times 10^8 m}{1sec} \times \frac{1mile}{1609m} \times \frac{60sec}{1min} = 1.118 \times 10^7 miles/min$$

6. Which of the following is not a base unit in the SI (System Internationale) unit system?
- Kilograms for Mass
 - Candela for Luminous Intensity
 - Liter for Volume
 - Meter for Length
7. Which of the following is an example of an Intensive Property?
- Mass
 - Temperature
 - Volume
 - All of these are Intensive Properties
 - None of these are Intensive Properties
8. Kelvin is the base unit for Temperature in the SI unit system. What is the temperature of the freezing point of water in the Kelvin Temperature scale?
- 0 K
 - 273.15 K
 - 100 K
 - 32 K
9. How many significant figures does the number 0.05080 have?
- 2
 - 3
 - 4
 - 5
10. Carry out the following calculation and express the result with the correct number of significant figures:
- $$1.110 \text{ cm} + 17.3 \text{ cm} + 108.2 \text{ cm} + 316 \text{ cm}$$
- 443 cm
 - 442.6 cm
 - 442.61 cm
 - 442.610 cm
11. Which of the following is not a pure substance.
- The compound Calcium Chloride (CaCl_2)
 - The element Sulfur (S)
 - Baking powder (contains 26% NaHCO_3 and the rest CaH_2PO_4)
 - Aspirin (aspirin is 100% Salicylic Acid, $\text{C}_9\text{H}_8\text{O}_4$)

- 12 Which of Dalton's 4 postulates for his Atomic Theory has not yet been experimentally refuted?
- All matter consists of atoms, tiny indivisible particles of an element that cannot be created or destroyed.
 - Atoms of one element cannot be converted into atoms of another element.
 - All atoms of an element are identical in mass and other properties and are different from atoms of any other element.
 - Compounds result from the chemical combination of a specific ratio of atoms of different elements.
- 13 The Conservation of Mass law states:
- In an isolated chemical system, the total mass of the substances in the system does not change during a chemical reaction.
 - No matter what its source, a particular chemical compound is composed of the same elements in the same fractions by mass.
 - Compounds composed of the same elements but in different proportions are different compounds
 - All atoms of an element have the same number of protons.
14. Magnesium Oxide (MgO) forms when Magnesium (Mg) burns in air. What is the mass fraction of Mg in MgO?
- 0.403
 - 0.397
 - 0.603
 - 0.500

$$\frac{24.31 \text{ g Mg}}{40.31 \text{ g MgO}} = 0.603$$

15. MgO (Magnesium Oxide) is a compound formed by an ionic bond between an Magnesium ion and an Oxygen ion. What is the charge of the Oxygen ion in this compound?
- a. +2
 - b. +1
 - c. 0
 - d. -1
 - e. -2
16. What is the Definition of the mass unit the Dalton (Da)?
- a. The mass of 6.022×10^{23} atoms of ^{12}C (Carbon-12)
 - b. The mass of 1 mole of ^{12}C (Carbon-12)
 - c. 1/12 the mass of an atom of ^{12}C (Carbon-12)
 - d. The mass of an atom of ^{12}C (Carbon-12)
17. True or False. The majority of the Volume of an atom is open space?
- a. True
 - b. False
18. Given the atomic symbol, $^{75}_{33}\text{As}$, how many neutrons does this atom contain?
- a. 33
 - b. 38
 - c. 75
 - d. 42
19. Chlorine has 2 naturally occurring isotopes, ^{35}Cl (isotopic mass 34.9858 Da, abundance 75.77%) and ^{37}Cl (isotopic mass 36.9659 Da, abundance 24.23%). What is the atomic mass of Chlorine?
- a. 34.9858 Da
 - b. 35.4655 Da
 - c. 35.9758 Da
 - d. 36.9659 Da

$$(34.9858\text{Da} \times 0.7577) + (36.9659\text{Da} \times 0.2423) = 35.4655\text{Da}$$

20. Most of the elements in the periodic chart are:
- Metals
 - Metalloids
 - Nonmetals
 - Nobel Gases
21. The atoms within a group (groups are those atoms in the same column in the periodic chart) on the Periodic Chart have:
- The same number of neutrons
 - Similar chemical properties
 - Decreasing size as the atomic number increases
 - The same number of protons
22. The radii of sodium (Na), potassium (K), Rubidium (Rb), and Cesium (Cs) ions are 102 pm, 138 pm, 184 pm, and 225 pm, respectively. Which ion forms the strongest ionic compound with Chlorine ions?
- Na⁺
 - K⁺
 - Rb⁺
 - Cs⁺
23. Diamond is a form of pure carbon. 1 Carat of diamond has a mass of 0.2000 grams. How many Carbon atoms are in 0.2000 grams (1 Carat) of Diamond?
- 1.446×10^{24} atoms of Carbon
 - 6.022×10^{23} atoms of Carbon
 - 1.003×10^{22} atoms of Carbon
 - 3.989×10^{-24} atoms of Carbon

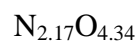
$$0.2000 \text{ gC} \times \frac{1 \text{ mole C}}{12.01 \text{ gC}} \times \frac{6.022 \times 10^{23} \text{ atoms C}}{1 \text{ mole C}} = 1.003 \times 10^{22} \text{ atom C}$$

24. A compound containing Nitrogen and Oxygen contains 30.45 mass % Nitrogen. What is the empirical formula of the compound?

- a. NO
- b. NO₂
- c. N₂O
- d. NO₃

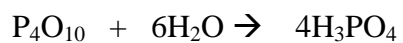
$$30.45 \text{ gN} \times \frac{1 \text{ mole N}}{14.01 \text{ gN}} = 2.17 \text{ mole N}$$

$$69.55 \text{ gO} \times \frac{1 \text{ mole O}}{16.00 \text{ gO}} = 4.34 \text{ mole O}$$



$$\frac{4.34}{2.17} = \frac{2}{1} \quad \text{NO}_2$$

25. Balance the following equation:



What is the stoichiometric (balancing) coefficient for the H₂O in this chemical equation after it has been balanced?

- a. 1
- b. 2
- c. 4
- d. 6

Extra Page for calculations

Periodic Table (Taken from IUPAC, 1995 -- Updated through June 1999)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
s^1	s^2	s^2d^1	s^2d^2	s^2d^3	s^2d^4	s^2d^5	s^2d^6	s^2d^7	s^2d^8	s^2d^9	s^2d^{10}	s^2p^1	s^2p^2	s^2p^3	s^2p^4	s^2p^5	s^2p^6
1 H Hydrogen g 1.00794	2 He Helium g 4.002602	3 Li Lithium g 6.941	4 Be Beryllium g 9.012182	5 B Boron g 10.811	6 C Carbon g 12.0107	7 N Nitrogen g 14.006434	8 O Oxygen g 15.9994	9 F Fluorine g 18.9984032	10 Ne Neon g 20.1797	11 Na Sodium g 22.98976928	12 Mg Magnesium g 24.304	13 Al Aluminum g 26.9815386	14 Si Silicon g 28.0855	15 P Phosphorus g 30.973761	16 S Sulfur g 32.06	17 Cl Chlorine g 35.453	18 Ar Argon g 39.948
19 K Potassium g 39.0983	20 Ca Calcium g 40.078	21 Sc Scandium g 44.955910	22 Ti Titanium g 47.88	23 V Vanadium g 50.9415	24 Cr Chromium g 51.9961	25 Mn Manganese g 54.938044	26 Fe Iron g 55.845	27 Co Cobalt g 58.933195	28 Ni Nickel g 58.6934	29 Cu Copper g 63.546	30 Zn Zinc g 65.39	31 Ga Gallium g 69.723	32 Ge Germanium g 72.61	33 As Arsenic g 74.9216	34 Se Selenium g 78.96	35 Br Bromine g 79.904	36 Kr Krypton g 83.80
37 Rb Rubidium g 85.4678	38 Sr Strontium g 87.62	39 Y Yttrium g 88.90584	40 Zr Zirconium g 91.224	41 Nb Niobium g 92.90638	42 Mo Molybdenum g 95.94	43 Tc Technetium [98]	44 Ru Ruthenium g 101.07	45 Rh Rhodium g 101.064	46 Pd Palladium g 106.42	47 Ag Silver g 107.8682	48 Cd Cadmium g 112.411	49 In Indium g 114.818	50 Sn Tin g 117.919	51 Sb Antimony g 121.760	52 Te Tellurium g 127.6	53 I Iodine g 126.90447	54 Xe Xenon g 131.29
55 Cs Cesium g 132.90545	56 Ba Barium g 137.327	57-71 * Lanthanides	72 Hf Hafnium g 178.49	73 Ta Tantalum g 180.9479	74 W Tungsten g 183.84	75 Re Rhenium g 186.207	76 Os Osmium g 190.23	77 Ir Iridium g 192.222	78 Pt Platinum g 195.078	79 Au Gold g 196.96655	80 Hg Mercury g 200.59	81 Tl Thallium g 204.3833	82 Pb Lead g 207.2	83 Bi Bismuth g 208.98038	84 Po Polonium [209]	85 At Astatine [210]	86 Rn Radon g 222
87 Fr Francium [223]	88 Ra Radium [226]	89-103 † Actinides	104 Rf Rutherfordium [261]	105 Db Dubnium [262]	106 Sg Seaborgium [263]	107 Bh Bohrium [264]	108 Hs Hassium [265]	109 Mt Meitnerium [266]	110 Uun Not named [267]	111 Uuh Not named [268]	112 Uub Not named [269]	113 Uuq Not named [270]	114 Uuq Not named [271]	115 Uuq Not named [272]	116 Uub Not named [273]	117 Uuq Not named [274]	118 Uuo Not named [275]

* 57 La Lanthanum g 138.9055	58 Ce Cerium g 140.116	59 Pr Praseodymium g 140.90765	60 Nd Neodymium g 144.24	61 Pm Promethium [145]	62 Sm Samarium g 150.36	63 Eu Europium g 151.964	64 Gd Gadolinium g 157.25	65 Tb Terbium g 158.92534	66 Dy Dysprosium g 162.50	67 Ho Holmium g 164.93032	68 Er Erbium g 167.26	69 Tm Thulium g 168.93421	70 Yb Ytterbium g 173.04	71 Lu Lutetium g 174.967
† 89 Ac Actinium [227]	90 Th Thorium g 232.0377	91 Pa Protactinium g 231.03628	92 U Uranium g 238.02891	93 Np Neptunium [237]	94 Pu Plutonium [244]	95 Am Americium [243]	96 Cm Curium [247]	97 Bk Berkelium [247]	98 Cf Californium [251]	99 Es Einsteinium [252]	100 Fm Fermium [257]	101 Md Mendelevium [258]	102 No Nobelium [259]	103 Lr Lawrencium [262]

The typical uncertainty in the listed atomic weights is 1-3 in the least significant digit. See the IUPAC table for the actual, experimental uncertainties.

† Geologically exceptional specimens are known in which the atomic weight is outside the IUPAC specified uncertainty range.

* Modified atomic weight outside the IUPAC specified uncertainty range may be found in commercial samples of this element that have undergone isotope separation or extraction.

[] Brackets denote a radioactive element that lacks a characteristic natural mixture of isotopes. The value stated is the nucleus number of the element's most stable nuclide. Th, Pa, and U have no stable isotopes, but their isotopes are so long lived that we can treat their atomic weights as meaningful.