Test Form 2

Instructions: You should have with you several number two pencils, an eraser, your 3" x 5" note card, a calculator, and your University ID Card. If you have notes with you, place them in a sealed backpack and place the backpack OUT OF SIGHT or place the notes directly on the table at the front of the room.

Fill in the front page of the Scantron answer sheet with your test form number (listed above), last name, first name, middle initial, and student identification number. **Leave the class section number and the test form number blank.**

This exam consists of 25 multiple-choice questions. Each question has four points associated with it. Select the best multiple-choice answer by filling in the corresponding circle on the rear page of the answer sheet. If you have any questions before the exam, please ask. If you have any questions during the exam, please ask the proctor. Open and start this exam when instructed. When finished, place your Scantron form and note card in the appropriate stacks. You may keep the exam packet, so please show your work and mark the answers you selected on it.

1 inch = 2.54 cm (exact)   1 mole = 6.02 x 10^{23}

1 H Hydrogen 1.0079																		2 He Helium 4.0026
3 Li Lithium 6.941	4 Be Beryllium 9.01218											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984	10 Ne Neon 20.179
11 Na Sodium 22.98977	12 Mg Magnesium 24.305											13 Al Aluminum 26.9815	14 Si Silicon 28.0855	15 P Phosphorus 30.97376	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.08	21 Sc Scandium 44.9559	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.996	25 Mn Manganese 54.9380	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.70	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.59	33 As Arsenic 74.9216	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.9059	40 Zr Zirconium 91.22	41 Nb Niobium 92.9064	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.4	47 Ag Silver 107.868	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.69	51 Sb Antimony 121.75	52 Te Tellurium 127.60	53 I Iodine 126.9045	54 Xe Xenon 131.30
55 Cs Cesium 132.9054	56 Ba Barium 137.33	57-71 *Rare earths	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.2	77 Ir Iridium 192.22	78 Pt Platinum 195.09	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.37	82 Pb Lead 207.2	83 Bi Bismuth 208.9804	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium 226.0254	89-103 †Actinides	104 Rf Rutherfordium (261)	105 Ha Hahnium (262)	106 Sg Seaborgium (263)	107 Ns Neilsbohrium (262)	108 Hs Hassium (265)	109 Mt Meltnerium (266)	110 ‡ (269)	111 ‡		114					

→ Stable region?

57 La Lanthanium 138.9055	58 Ce Cerium 140.12	59 Pr Praseodymium 140.9077	60 Nd Neodymium 144.24	61 Pm Promethium 145	62 Sm Samarium 150.4	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.9254	66 Dy Dysprosium 162.50	67 Ho Holmium 164.9304	68 Er Erbium 167.26	69 Tm Thulium 168.9342	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
89 Ac Actinium 227.0278	90 Th Thorium 232.0381	91 Pa Protactinium 231.0359	92 U Uranium 238.029	93 Np Neptunium 237.0482	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (254)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium 259	103 Lr Lawrencium 262

1. A student measures the length of a lithium bromide crystal to be 0.0760 cm.

    ③

    (A)   There are two significant figures in this measured quantity.
    (B)   There are three significant figures in this measured quantity.
    (C)   There are four significant figures in this measured quantity.
    (D)   There are five significant figures in this measured quantity.
    (E)   There are six significant figures in this measured quantity.

2. Consider the following operation: 0.0334 cm * 34.549 cm. The correct answer with the proper number of significant figures is: ③   ⑤   limited to 3 sig figs

    (A)   None of the below
    (B) 1.15394 cm^2 1.1539366 cm^2
    (C) 1.1539 cm^2
    (D) 1.154 cm^2
    (E) 1.15 cm^2

3. Which of the following contains a statement that is **false**?

    (A)   Calcium fluoride is an ionic compound and carbon dioxide is a molecule. true
    (B)   Lithium is an element and dinitrogen tetroxide is a molecule. True
    (C) NH_3 is a molecule and C_8H_{18} is a molecule. True
    (D)   Orange juice with pulp is heterogeneous and brass is an alloy. True
    (E)   Carbon tetrachloride is an ionic compound and fluorine is a non-metal. False

        CCl_4 is a molecule

4. Consider ammonium phosphate, $(NH_4)_3PO_4$ (s). How many of each type of atom are present in the ion?

    (A)   Three nitrogen atoms, one phosphorus atom, and four oxygen atoms
    (B)   Three nitrogen atoms, four hydrogen atoms, one phosphorus atom, and four oxygen atoms
    (C)   Three nitrogen atoms, twelve hydrogen atoms, one phosphorus atom, and four oxygen atoms
    (D)   Three nitrogen atoms, one phosphorus atom
    (E)   Twelve nitrogen atoms, one phosphorus atom, and four oxygen atoms

    12 - H NH_4^+ NH_4^+
    4 - O PO_4^{3-}
    1 - P
    3 - N NH_4^+
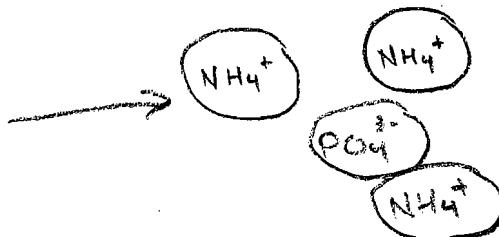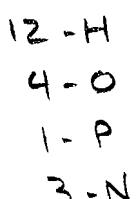
5. Which of the following chemical formulae is **incorrect**?

    (A) LiBr
    (B) MgO
    (C) BaCO₃
    (D) CaF   could be CaF₂
    (E) BaSO₄

    (handwritten ion diagrams: Li⁺ Br⁻; Mg²⁺ O²⁻; Ba²⁺ CO₃²⁻; Ca²⁺ F⁻ F⁻; Ba²⁺ SO₄²⁻)
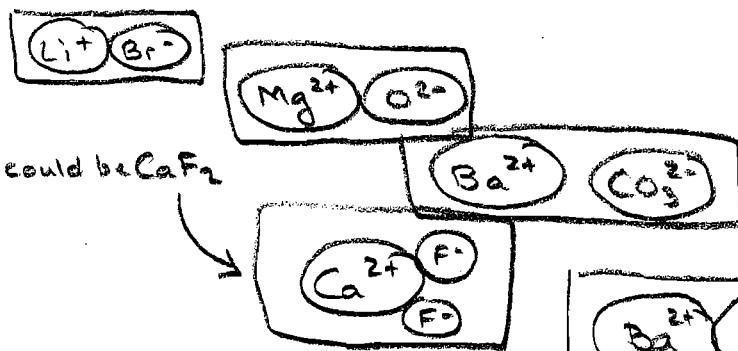
6. $^{197}Au^{3+}$ has:

    (A) 79 **protons**, 79 **neutrons**, 197 **electrons**
    (B) 197 **protons**, 118 **neutrons**, 118 **electrons**
    (C) 118 **protons**, 118 **neutrons**, 79 **electrons**
    (D) 79 protons, 118 neutrons, 82 electrons
    (E) 79 **protons**, 118 **neutrons**, 76 **electrons**

    79 ← 79 p
    Au ← 79 e⁻ minus 3 = 76 e⁻ because of the 3+ charge

    neutrons = 197 - 79 = 118

7. A student measures the volume of a sodium bromide crystal to be 0.2934 cm³. Expressed in inches³, this volume is:

    (A) 0.7452 inches³
    (B) 0.1155 inches³
    (C) 4.808 inches³
    (D) 0.01790 inches³
    (E) 8.657 inches³

    $0.2934 \ cm^3 \left(\dfrac{1 \ in}{2.54 \ cm} \right)^3 = 0.01790 \ in^3$

    $\left(\dfrac{1 \ inch^3}{16.39 \ cm^3} \right)$

8. Two elements that will form 2+ ions in ionic compounds are:

    (A) O and S
    (B) N and P
    (C) Cl and Br
   (D) Ba and Ca   Group 2 so Ba²⁺ and Ca²⁺
    (E) Na and K

9.   The chemical formula of magnesium phosphate is:

    (A) Mg_2P
    (B) $MgPO_4$
    (C) Mg_2PO_4
    (D) $Mg_2(PO_4)_3$
   (E) $Mg_3(PO_4)_2$

(handwritten) Mg^{2+} PO_4^{3-} Mg^{2+} PO_4^{3-} Mg^{2+}
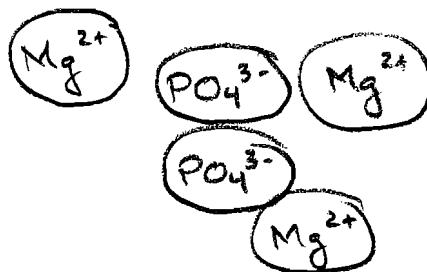
10.   Which of the following chemical formulae is **incorrect**?

    (A) CH_4
    (B) H_2O
    (C) NH_5
    (D) CH_3F
    (E) CH_3OH

(handwritten structures) H-C-H with H top and bottom; H-O-H; H-N-H with H; H-C-H with F; H-C-O-H

(handwritten) 3 bonds to N okay — not 5
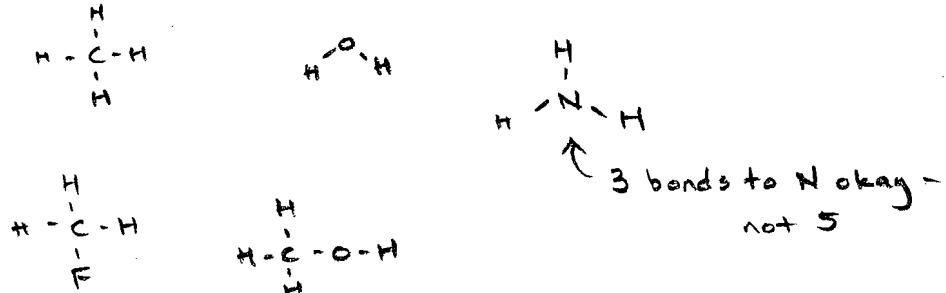
11.   When combined with sulfur, a Group 1 element will tend to:

    (A)   Gain one electron
    (B)   Gain two electrons
    (C)   Lose one electron
    (D)   Lose two electrons
    (E)   Donate a proton

(handwritten) Metals Lose e⁻
Group 1 Lose 1
Group 2 Lose 2

12.   Which of the following pairs of elements will form an ionic compound?

    (A)   Helium and lithium
    (B)   Sodium and potassium
    (C)   Lithium and calcium
    (D)   Neon and xenon
    (E)   Carbon and nitrogen *(Carbon crossed out, replaced with "Barium")*

(handwritten) Metal + Non-metal

Ba^{2+} N^{3-}
Ba_3N_2
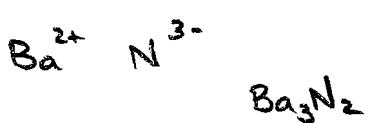
13.   Which of the following pairs are isotopes?

    (A) ^{16}N and ^{16}O
    (B) ^{15}N and ^{16}O
    (C). ^{40}Ar and ^{20}Ne
    (D) $^{20}F^-$ and ^{20}Ne
    (E) ^{15}O and ^{16}O

(handwritten) → Same element (same number p) different number of n

14.   The mass percent composition of hydrogen in ammonium chloride, NH_4Cl, is:

(A)   1.88%
(B)   7.53%
(C)   16.67%
(D)   26.19%
(E)   33.33%

$14.01 \, ^g/_{mol}$ $35.453 \, ^g/_{mol}$

$4 * 1.008 \, ^g/_{mol}$

Whole = $53.495 \, ^g/_{mol}$

All hydrogen

% Hydrogen = $\left(\dfrac{4 * 1.008 \, ^g/_{mol}}{53.495 \, ^g/_{mol}} \right) \cdot 100\% = 7.53\%$
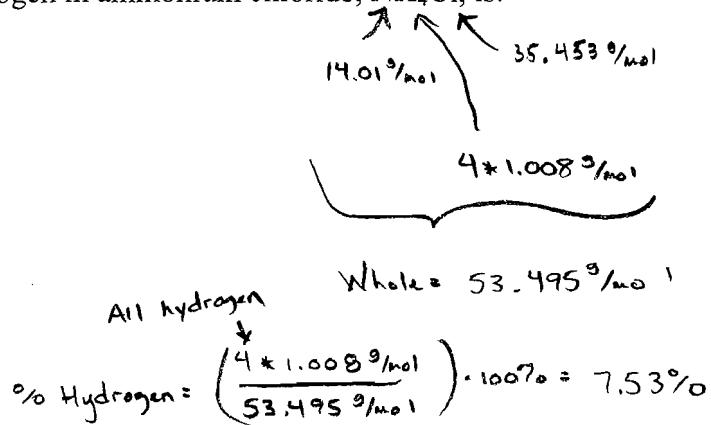
15.   The chemical formula of cesium carbonate is:

(A)   CsC
(B) Cs_4C
(C) $CsCO_3$
(D) Cs_2CO_3
(E) $Cs_3(CO_3)_2$

Cs^+ CO_3^{2-} Cs^+

16.   The name of N_2O_4 is?

(A)   dinitrogen pentoxide
(B)   nitrate
(C)   pernitritethingamajig
(D)   nitrogen oxide
(E)   dinitrogen tetroxide

di = 2   tetra = 4   (the "a" is dropped to avoid a double vowel)

Molecules (non-metals only) need prefixes

17.   Which of the following is a metal?

(A)   neon
(B)   titanium
(C)   sulfur
(D)   carbon disulfide
(E)   lithium hydroxide

Metals   Non-metals

18. A fictitious element, Blackboardium, has two naturally occurring isotopes. ^{301}Bb has a mass of 300.21 g/mol and is 31.6013% abundant. ^{304}Bb has a mass of 303.16 g/mol and is 68.3987% abundant. What is the average atomic mass of Blackboardium?

   (A) 301.69 g/mol
   (B) 301.93 g/mol
   (C) 302.23 g/mol
   (D) 302.51 g/mol
   (E) 302.77 g/mol

$$(300.21 \,{}^g/mol)(0.316013) + (303.16 \,{}^g/mol)(0.683987) =$$

$$302.23 \,{}^g/mol$$

19. The atomic mass of calcium is:

   (A) 6.66×10^{-23} g/mol
   (B) 2.41×10^{25} g/mol
   (C) 20 g/mol
   (D) 20.00 g/mol
   (E) 40.08 g/mol

   20
   Ca
   40.08 ← atomic mass
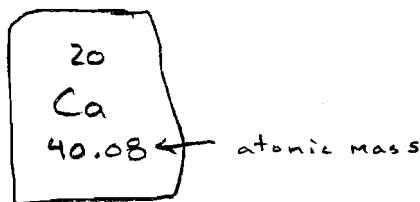
20. The molar mass of magnesium chloride is:

   (A) 39.84 g/mol
   (B) 59.76 g/mol
   (C) 84.06 g/mol
   (D) 95.21 g/mol
   (E) 119.52 g/mol

   $MgCl_2$

   2 * 35.453 $^g/mol$

   24.305 $^g/mol$

   95.21 $^g/mol$
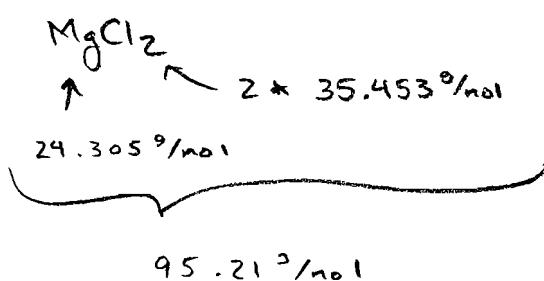
21. A student (🧍) obtains 73.05 grams of carbon. This is:

(A) 6.08 moles ~~6.08 moles~~

(B) 877.4 moles

(C) 1.45×10^{-21} moles

(D) 1.21×10^{-22} moles

(E) 12.011 moles

$$73.05g \left(\frac{1\ mol}{12.011\ g} \right) = 6.08\ mol\ C$$

22. A student (🧍) obtains 87.68 grams of neon. This is:

(A) 4.35 neon atoms

(B) 1769 neon atoms

(C) 2.62×10^{24} neon atoms

(D) 5.28×10^{25} neon atoms

(E) 1.46×10^{-22} neon atoms

$$87.68g\ Ne \left(\frac{1\ mol}{20.179\ g} \right) \left(\frac{6.02 \times 10^{23}\ Ne\ atoms}{1\ mol} \right) = 2.62 \times 10^{24}\ Ne\ atoms$$

23. When the reaction

$C_{11}H_{24}$ (l) + **17** O_2 (g) → **11** CO_2 (g) + **12** H_2O (g) is correctly balanced,

↑

34 oxygen atoms

22 + 12 = 34 oxygen atoms
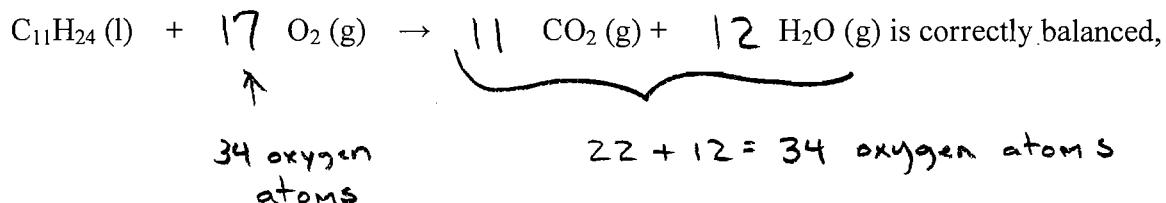
(A) 17 O_2 are consumed.
(B) 11 O_2 are consumed.
(C) 22 O_2 are consumed.
(D) 12 O_2 are consumed.
(E) 34 O_2 are consumed.

24. A student ( ) places 116.9 grams of sodium chloride into a 4.000-L volumetric flask and fills to the mark with water. The concentration of this solution is:

(A) 116.9 M NaCl
(B) 58.45 M NaCl
(C) 2.000 M NaCl
(D) 0.008554 M NaCl
(E) 0.5000 M NaCl

$$M = \frac{mol}{L} = \frac{\left(\frac{116.9 \ g \ NaCl}{58.45 \ g/mol}\right)}{4.000 \ L} = 0.5000 \ M$$

25. Because of Chemistry 121...

(A) I drift out of consciousness when I hear the words "ChemSkill Builder."
(B) I have become a social butterfly.
(C) My softball average has increased from .285 to .460.
(D) I have laughed more times in the past four weeks than I have in the previous four years.
(E) My bad cholesterol has dropped 40 points and my good cholesterol has increased 40 points.
   [Any response will receive full credit; even no response.]