

Chem 151

Disclaimer: This is a SAMPLE of possible questions that might be asked on your exam.

Other material covered in lecture that does not appear on this exam may still appear on your first exam.

Sample Exam I - KEY

$$1 \text{ mL} = 1 \text{ cm}^3$$

$$1 \text{ inch} = 2.54 \text{ cm}$$

$$1 \text{ mile} = 1.6093 \text{ km}$$

$$1 \text{ lb} = 453.59 \text{ g}$$

$$T_{\text{F}} - 32 = 1.80 \times T_{\text{C}}$$

$$1 \text{ gal} = 4 \text{ qt} = 3.7854 \text{ L}$$

Remember to use proper significant figures and units and please circle your final answer.

Please show ALL work for full credit.

- Please write the correct symbol for the element described as follows:
 - Ba** The alkaline earth metal in period six.
 - B** The semimetal in period two.
 - S** The nonmetal in period three with a 2- charge as an ion.
 - Fe** The transition metal with the following noble gas configuration: $[\text{Ar}]4s^2 3d^6$
 - P** The nonmetal with only 15 protons in its nucleus.

- What mass of helium, **in cg**, is in a 250.0 mL balloon? ($d = 0.164 \text{ g/L}$)

$$250.0 \text{ mL}(1 \text{ L} / 1000\text{mL})(0.164 \text{ g/L})(100 \text{ cg}/1 \text{ g}) = 4.10 \text{ cg}$$

- The mercury in thermometers freezes at -38.9°C . What is this temperature in degrees Fahrenheit?

$$-38^{\circ}\text{F}$$

- Please indicate physical with **P** and chemical with **C** for the following properties:

- | | |
|-------------------------|--------------------------|
| a. P temperature | b. P conductivity |
| c. C hardening | d. P solubility |
| d. P density | e. C tarnishing |

- When a 45.0 g golf ball is hit, it takes off at a speed of 41 m/s. What is the de Broglie wavelength of the golf ball?

$$\lambda = h/(mv) = 6.626 \times 10^{-34} \text{ kg m}^2 \text{ s}^{-1} / [(45.0 \text{ g}/1000)(41 \text{ m/s})] = 3.59 \times 10^{-34} \text{ m}$$

- Circle all of the following bonds that are *covalent*. **Covalent is between two nonmetals!**

Br-Cl

K-O

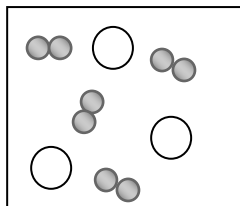
O-I

Na-N

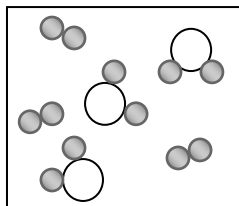
S-O

Se-F

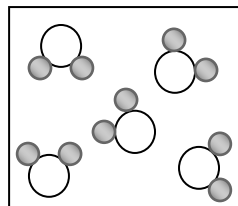
7. Each of the boxes below shows a molecular-level representation in which atoms are represented by circles. Which box represents a mixture of two elements?



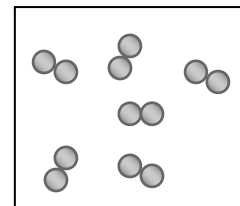
a.



b.



c.



d.

8. Please match the scientist with their important discovery.

- | | |
|---------------|---|
| a. Rutherford | i. <u>c</u> the presence of negatively charged particles. |
| b. Lavoisier | ii. <u>d</u> the charge of a single electron. |
| c. Thomson | iii. <u>e</u> the Law of Conservation of Mass by heating HgO. |
| d. Millikan | iv. <u>a</u> the presence of a small, central, & positive nucleus in atoms. |
| e. Priestley | v. <u>b</u> the Law of Definite Proportions. |

9. What is the energy, in kJ/mol, of red light with a wavelength of 653 nm?

$$v=c/\lambda \quad E = hc/\lambda \quad = \frac{6.626 \times 10^{-34} \text{ Js}(1 \text{ kJ}/1000\text{J})(6.022 \times 10^{23} \text{ photons/mol})(3.00 \times 10^8 \text{ m/s})}{653 \text{ nm} (1 \text{ m}/1 \times 10^9 \text{ nm})} = 183 \text{ kJ/mol}$$

10. Calculate the cost in dollars for chili powder if 435 dorm residents eat an average of 213 grams of chili each.

There are 2.21 teaspoons of chili powder per pound of chili, 1.00 teaspoon of chili powder weighs 0.045 oz and the powder costs 38 cents per ounce. (16 oz = 1 lb).

\$7.72

11. Please write the noble gas configuration for the following elements:

- | | |
|-------|---|
| a. Cu | [Ar] 4s¹3d¹⁰ |
| b. Al | [Ne]3s²3p¹ |
| c. Li | [He] 2s¹ |
| d. Sr | [Kr]5s² |

12. The distance between the K⁺ and Cl⁻ ions in a crystal of KCl is 3.14 x 10⁻⁸ cm. What is the frequency of light whose wavelength will fit just once between the centers of the two ions?

$$c = v\lambda \quad v=c/\lambda = 3.00 \times 10^8 \text{ m/s} / [3.14 \times 10^{-8} \text{ cm}(1 \text{ m}/100\text{cm})] = 9.55 \times 10^{17} \text{ s}^{-1}$$

13. What is the maximum number of electrons in an atom whose highest-energy electrons have the principal quantum number $n = 3$ and the angular-momentum quantum number $l = 2$?

$$n = 3 \quad l = d \text{ orbital} = 3d = 10 \text{ electrons}$$

14. List the following orbitals for a multielectron atom according to increasing energy: **4d, 3p, 5s, 2p**

$$2p < 3p < 5s < 4d$$

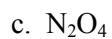
15. Complete the following table:

Name	Mass Number	Number of Protons	Number of Neutrons	Number of Electrons
^{208}Pb	208	82	126	82
$^{32}\text{S}^{2-}$	32	16	16	18
$^{42}\text{Ca}^{2+}$	42	20	22	18

16. Determine whether the following are molecular or ionic compounds:



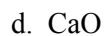
Molecular / Ionic



Molecular / Ionic



Molecular / Ionic



Molecular / Ionic

Extra Credit:

Naturally occurring boron consists of two isotopes: ^{10}B and ^{11}B . If ^{10}B is 19.90% abundant and has an isotopic mass of 10.0129 amu, what is the mass of ^{11}B ?