US 110 Exam 1. Jordan, Fall 2005

46 (not graded)

Name Key

By submitting this exam, I affirm that I have neither given nor received unauthorized aid on this assignment.
You must show all work for credit. Express each answer to the correct number of significant figures.

Useful information: 1 m = 1.094 yd, $°C = \frac{5}{9}(°F - 32)$ $°F = \frac{9}{5}(°C) + 32$, 1 in =2.54 cm, 1 kg = 2.2 lbs, 1 mL= 1 cm^3, 1 L = 1.056 qt

(1)(4 points) Describe the difference between the plum or raisin pudding model of the atom and Rutherford's model of the atom.

In the plumb (raisin) pudding model, the protons & electrons are both evenly distributed throughout the atom.

In Rutherford's atom protons

The protons are in a tiny positively charged nucleus and most of the volume of the atom is made up of electrons

(2)(2 points) Fill in the following table

isotope	protons	neutrons	electrons
$^{32}_{14}Si$	14	18	14
$^{210}_{82}Pb$	82	128	82

(3)(3.5 points) List the 7 base SI units and the property each one measures

meters	length
kilograms	mass
second	time
Kelvin	temperature
candela	luminous intensity
mole	amount of something
Ampere	current

(7)(5 points) List 4 points of Dalton's Atomic theory including the one that was later found to be incorrect (and circle the one that was incorrect).

On p40 of the textbook

(8)(5 points) The density of mercury is 13.59 g/mL. What volume of mercury has a mass of ~~100~~ 125 kg? Would this fit into a 2 L pop bottle?

125 kg = 125,000 g

$125{,}000\ g \times \frac{1\ mL}{13.59\ g} = 9.20 \times 10^{3}\ mL$

no, it is over 9 L.

(9)(4 points) Whose experiment determined the mass of the electron? How did he do it?

Robert Millikan. He suspended charged oil drops between 2 charged plates. The charge on the oil drops was always an integer multiple of the charge on the electron.

(10)(4 points) Classify the following as either element, compound, heterogeneous mixture, or homogeneous mixture.

(a) table salt compound

(b) water compound

(c) sucrose compound

(d) Windex® window cleaner homogeneous solution

(11)(4 points) On another planet, calcium has only two naturally occurring isotopes. Given the information below what is the average molecular weight that should go on the periodic table for the planet (this will not be the actual mass on OUR the periodic table).

^{40}Ca mass = 39.963 amu, abundance = 71.58%

^{46}Ca mass = 45.954 amu, abundance = 28.42%

$0.7158(39.963\text{amu}) + 0.2842(45.954\text{amu}) = 41.67\text{amu}$

(12)(4 points) Perform the following calculations to the correct number of significant figures.

(a) $\dfrac{263.5973 + 2.37}{62.375 - 0.055} = \dfrac{265.97}{62.320} = 4.2678$

(b) $763.63 + 0.004 + 0.05 = 763.69$

(13) Fill in the following table (4 points)

	Formula	Name
a	H_2SO_4	Sulfuric acid
b	$CaCl_2$	calcium chloride
c	SO_3	sulfur trioxide
d	$Fe(NO_3)_3$	iron (III) nitrate

(14) Extra Credit(4 pts): A certain copper mine processes an ore that is almost pure Cu_2O. After opening up a new vein, the operators found that the normal processing wasn't working with the ore. The analysis of the copper compound in the ore found that it was 20.1% oxygen and 79.9%Cu. Why isn't the process working? This question is an example of what law?

SOLVE=

Cu_2O FW = 143.1 g/mol

$\%O = \frac{16 \text{ g/mol}}{143.1 \text{ g/mol}} = 11.2\%\ O$

$\%Cu = \frac{127 \text{ g/mol}}{143.1 \text{ g/mol}} = 88.8\%\ Cu$

∴ the ore isn't Cu_2O

If I have 100g of the unknown ore

20.1 g is O ÷ 16 g/mol = 1.26 moles O

79.9 g is Cu ÷ 63.55 g/mol = 1.26 moles Cu ∴

CuO different oxide thats why the process doesn't work

Law of Multiple Proportions

(4)(8 points) Conversions

(a) Convert 37 in to m $\frac{37\,in}{1} \times \frac{2.54\,cm}{in} = 93.98\,cm$

$93.98\,cm \times \frac{1\,m}{100\,cm} = \boxed{0.94\,m}$

(b) What is -40 °C in °F?

$\frac{9}{5}(-40°C) + 32 \quad \boxed{-40°F}$

(c) Convert 26.5 cm to nm $\frac{26.5\,cm}{1} \times \frac{1\,m}{100\,cm} = 0.265\,m$

$0.265\,m \times \frac{1\,nm}{10^{-9}\,m}$ $\boxed{2.65 \times 10^{8}\,nm}$

(d) ~~4.04 m³~~ $4.04 \times 10^{2}\,mL$ to quarts

$4.04 \times 10^{2}\,mL = 0.404\,L \qquad 0.404\,L \times \frac{1.0567\,qt}{1\,L} = \boxed{0.427\,qt}$

(5)(4 points) Balance the following equations

(a) $6H_2O + P_4 + 5O_2 \longrightarrow 4H_3PO_4$

(b) $C_2H_4 + 2O_2 \longrightarrow 2CO + 2H_2O$

(6)(2 points) Complete the equation by switching the cations and anions of the reagents, then balance the equation (metathesis reaction)

$2\,(NH_4)_3PO_4 + 3Ca(OH)_2 \longrightarrow 6NH_4OH + Ca_3(PO_4)_2$