

Chemistry 1105 R11 Fall 2011 Test 1

Friday, September 30, 2011

Time: 1 hour 50 minutes

Name: ANSWERS

Student Number: _____

This test consists of **seven** pages of questions, a periodic table, and a page containing the names, symbols, and masses of the elements. Please ensure you have a complete paper and, if you do not, obtain one from me **immediately**. There are **36** marks available. Good luck!

1) [5 marks total] The sun consumes 620 million metric tons of hydrogen each second. One metric ton is 1000 kg.

a) [2 marks] How many pounds of hydrogen are consumed per hour? One pound is 453.6 grams.

$$620 \times 10^6 \frac{\text{tonnes}}{\text{s}} \times \frac{1000 \text{ kg}}{1 \text{ tonne}} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \frac{60 \text{ s}}{1 \text{ min}} \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ lb}}{453.6 \text{ g}}$$

$$= \boxed{4.92 \times 10^{15} \frac{\text{lbs}}{\text{hr}}}$$

b) [3 marks] If that hydrogen were used to produce water instead, how many km^3 of water could be produced each second? 2.02 grams of hydrogen produces 18.02 grams of water, and 1 cm^3 of water has a mass of 0.998 grams.

$$620 \times 10^6 \frac{\text{tonnes}}{\text{s}} \times \frac{1000 \text{ kg}}{1 \text{ tonne}} \times \frac{1000 \text{ g}}{1 \text{ kg}} \times \left(\frac{18.02 \text{ g}}{2.02 \text{ g}} \right) \times \left(\frac{1 \text{ cm}^3}{0.998 \text{ g}} \right) \times$$

$$\rightarrow \left(\frac{1 \text{ m}}{100 \text{ cm}} \right)^3 \left(\frac{1 \text{ km}}{1000 \text{ m}} \right)^3 = \boxed{5.54 \text{ km}^3}$$

- 2) [3 marks] A beaker was completely filled with a certain liquid. The mass of the beaker and liquid was 1000.00 grams. A rock of mass 240.00 grams and density 8.00 g/mL was added to the beaker, which caused some of the water to spill out (the volume of water spilled exactly equalled the volume of the rock). If the mass of the rock, beaker, and the liquid that didn't spill out of the beaker was 1216.00 grams, what was the density of the liquid?

$$\text{beaker} + \text{all liquid} + \text{rock} = 1240 \text{ g}$$

$$\text{beaker} + \text{some " } + \text{rock} = 1216 \text{ g}$$

\therefore 24g liquid spilled.

$$V_{\text{liquid}} = V_{\text{rock}} = 240 \text{ g} \times \frac{1 \text{ mL}}{8 \text{ g}} = 30 \text{ mL}$$

$$\therefore D_{\text{liquid}} = \frac{24 \text{ g}}{30 \text{ mL}} = 0.8 \frac{\text{g}}{\text{mL}}$$

- 3) [3 marks] A 4.00-kg sample of S_8 was converted to SO_2 , and a 600-gram sample of S_8 was converted to S_2O_3 . Calculate the ratio $\frac{\text{mass of O in SO}_2}{\text{mass of O in S}_2\text{O}_3}$.

$$\frac{4000 \text{ S}_8 \times \frac{85}{158} \times \frac{20}{15}}{600 \text{ S}_8 \times \frac{85}{158} \times \frac{30}{25}} = \frac{64,000}{7200} = \frac{640}{72} = \frac{80}{9}$$

4) [4 marks total] The average atomic mass for gallium is 69.723 u.

a) [3 marks] Complete the following table for gallium:

Nuclide Symbol	isotope mass (u)	percent abundance
${}^{69}_{31}\text{Ga}$	68.9256	60.11
${}^{71}_{31}\text{Ga}$	70.9247	39.89

$x =$ fractional abundance ${}^{69}_{31}\text{Ga}$
 $y =$ " " " ${}^{71}_{31}\text{Ga}$

then: $x + y = 1$
 and $68.9256x + 70.9247y = 69.723$
 $\rightarrow 68.9256x + 68.9256y = 68.9256$

 $1.9991y = 0.7974$
 $y = .3989, \text{ or } 39.89\%$

b) [1 mark] Assuming neutral atoms, which of the two isotopes of gallium has more electrons?

They both will have 31.

5) [3 marks] Give the symbol for an element that satisfies the conditions indicated:

occurs naturally as a diatomic liquid Br

a group IVA semiconductor Si

a group IA non-metal H

has no stable isotopes and has $A = 238$ U

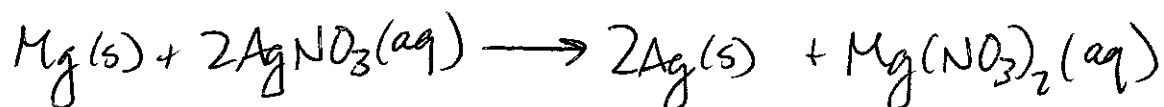
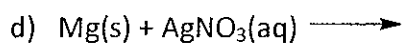
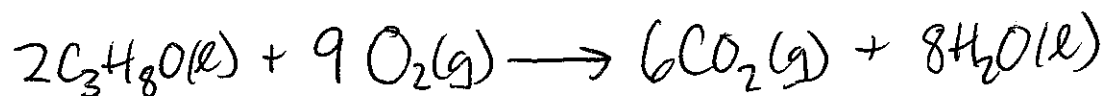
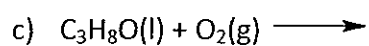
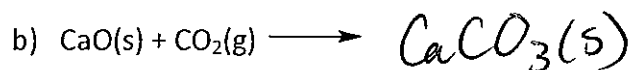
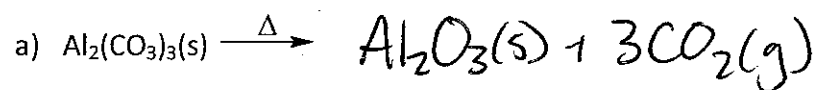
a transition metal that's not a ~~metal~~ ^{solid.} at room temperature Hg

a group VIIA solid I

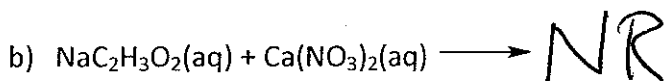
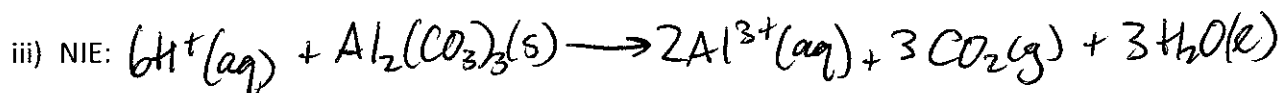
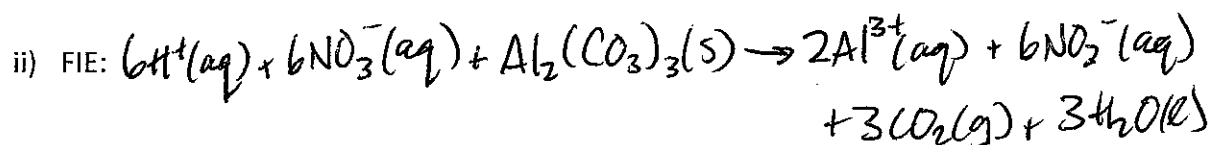
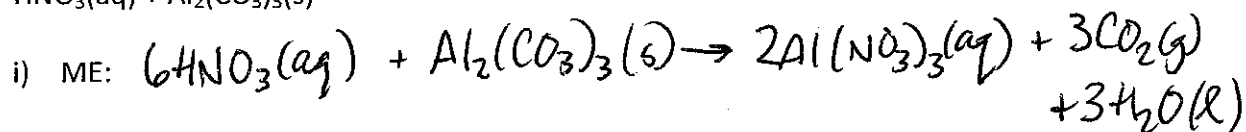
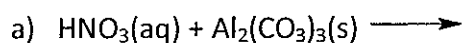
6) [8 marks] Complete the following table:

Formula	Name
CaCl_2	Calcium chloride
K_3N	potassium nitride
Fe_3P_2	iron(II) phosphide
Co_2O_3	cobalt(III) oxide
KClO_2	potassium chlorite
$\text{Al}_2(\text{SO}_3)_3$	aluminum sulphite
NiCO_3	nickel(II) carbonate
NH_4BrO_4	ammonium perbromate
$\text{Li}_2\text{S} \cdot 9\text{H}_2\text{O}$	lithium sulphide nonahydrate
$\text{Hg}_2(\text{NO}_2)_2 \cdot 2\text{H}_2\text{O}$	mercury(I) nitrite dihydrate
$\text{H}_2\text{S}(\text{g})$	hydrogen sulphide
HIO_4	periodic acid
HClO	hypochlorous acid
$\text{Ca}(\text{OH})_2$	calcium hydroxide
ClO_2	chlorine dioxide
P_2O_5	diphosphorus pentoxide

- 7) [4 marks] Complete and balance the following reactions. Indicate the phases of all reactants and products. You only need to show the molecular equations. Assume a reaction occurs in each case.



8) [4 marks] Complete and balance the following equations, providing the molecular, full ionic, and net ionic equation for each. Indicate the phases and (where necessary) charges for all reactants and products. If you do not expect a reaction to occur, indicate so after the molecular equation arrow with an "NR."



i) ME:

ii) FIE:

iii) NIE:

9) [2 marks] Give the oxidation number of sulphur in each of the following compounds or ions:

