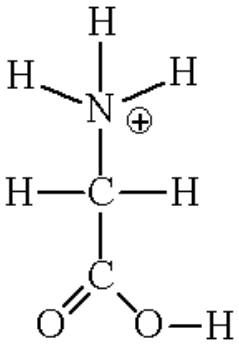
EASY QUESTION 1

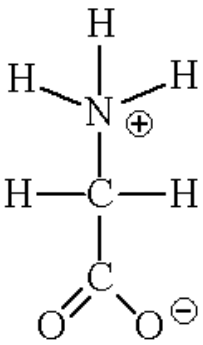
Team ID: _____

Acid/Base

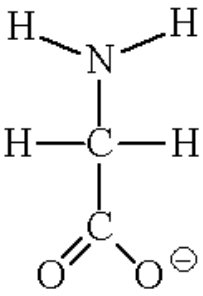
Amino acids are considered zwitterionic because they have both a positively and negatively charged sites. Consider the following three images of the amino acid glycine. Using your knowledge of Bronsted-Lowry acids and bases, *determine if the glycine depicted is in an acidic, basic, or neutral solution.*



a



b



c

a) The glycine at position a is in a solution that is _____ (acidic, basic, neutral)
Acidic
b) The glycine at position b is in a solution that is _____ (acidic, basic, neutral)
neutral
c) The glycine at position c is in a solution that is _____ (acidic, basic, neutral)
Basic

EASY QUESTION 2

Team ID: _____

Electrochemistry

When 3.0 mL of 6.0 M HCl is added to 20.0 g of Zn metal, bubbles appear to form on the metals surface. *Give the net ionic equation of this reaction as well as the initial and final oxidation numbers of the reducing agent*. Please include the states of matter

$2H^{+}(aq) + Zn(s) \rightarrow Zn^{2+}(aq) + H_2(g)$

Initial Oxidation #: 0
Final Oxidation #: +2

EASY QUESTION 3

Team ID: _____

Chemical Reactions

Consider the following reaction:

$3C(s) + 4H(g) \rightarrow C_3H_8(g)$, $\Delta H = -58kJ$

How much heat is released if 8.0 g of C(s) are present, and consumed, in the reaction?

$$\frac{8g\ C(s)}{1} \cdot \frac{1mol\ C(s)}{12\ g\ C(s)} \cdot \frac{1mol\ C3H8(g)}{3\ mol\ C(s)} \cdot \frac{-58kJ}{1\ mol} = -12.89\ kJ$$

MEDIUM QUESTION 1 Team ID: _____

Physical Properties

A student has 16.68 g of solid carbon. He burns the carbon in the rigid vessel of 2.0 L at 25ºC until all the carbon has turned into carbon dioxide. The final pressure of the vessel is 17 atm. *What was the initial pressure of the vessel?* Assume temperature remains constant at 25ºC throughout the reaction. Note: The gas constant R = 0.0821 $atm \times L \times mol^{-1} \times K^{-1}$

17 atm --- Note: The reaction has a 1 mole O_2 to 1 mole CO_2. . No pressure change occurs

MEDIUM QUESTION 2 Team ID: _____

Equilibrium

The chemistry department at Peeti University want to mix all their chemicals containing chloride together. In their chemical closet they have 9.7 g of NaCl, 13.4 g of AgCl, 523 mL of 0.40 M $MgCl_2$, and 200.0 mL of 0.56 M FeCl2. Assuming that they mix together all these compounds, *what is the concentration of chloride in the resulting solution?*

9.7 g NaCl * (1 mol NaCl / 58.44 g NaCl) * (1 mol Cl^- / 1 mol NaCl) = 0.166 moles Cl^-

AgCl is not soluble

523 mL * (1L / 1000 mL) * (0.40 mol $MgCl_2$ / L) * (2 mol Cl^- / 1 mol $MgCl_2$) = 0.418 moles Cl^-

200 mL * (1L / 1000 mL) * (0.56 mol $FeCl_2$ / L) * (2 mol Cl^- / 1 mol $FeCl_2$) = 0.224 moles Cl^-

$[Cl^-]$ = (0.166 moles Cl^- + 0.418 moles Cl^- + 0.224 moles Cl^-) / (.523 L + .200 L)
= 1.118M

HARD QUESTION 1 Team ID: _____

Thermochemistry

In order to be reborn, phoenixes will a store a lot of energy near the end of its lifetime in order to combust. When scientists submerged a 1.0 kg phoenix in water within a closed system, they noted a 4 ºC increase to the 10.0 L of water. Through other calculations, they noted that the change in entropy was 550.0 J for the combustion of the 1 kg phoenix. Assuming that the heat released and the entropy of a phoenix's combustion is directly proportional to the weight of the phoenix. *What is the Gibbs free energy of a 2.0 kg phoenix's combustion at 25 ºC?*

Density of water = $1 g/cm^3$; $1 cm^3 = 1mL$
Specific Heat of water = $4.184 J \times K^{-1} \times g^{-1}$

$\Delta H = 4.184*10{,}000g*4 = 167{,}360$ J -> negative since heat released
$\Delta G = 2(-167{,}360J) - 2(550)(298) = -662, 520$ J
-662.52 KJ