

FUNDAMENTALS OF CHEMISTRY 1A (CHEM1001) - June 2006

2006-J-2

- ${}_{91}^{234}\text{Pa}$
- ${}_{90}^{230}\text{Th}$
- 4.3 mol 0.85 kg
- phosphorus
- 0.353 m

2006-J-3

- The crystal structure of a metal consists of a lattice of positively charged nuclei surrounded by a “sea of electrons”. These electrons are free to move under the influence of an electric field so can conduct the current. An ionic solid consists of a lattice of positive and negative ions, packed together to minimise repulsion and maximise attraction. The atomic nuclei are fixed in place and all the electrons are localised around them so they are unable to conduct the current (They can conduct current when molten as the ions are then free to move.)

- | | | | | | | |
|-----------|----|----|----|----|----|-------------------------|
| lithium | Li | 7 | 3 | 3 | 4 | ${}_{3}^{7}\text{Li}$ |
| copper | Cu | 64 | 29 | 29 | 35 | ${}_{29}^{64}\text{Cu}$ |
| aluminium | Al | 27 | 13 | 13 | 14 | ${}_{13}^{27}\text{Al}$ |

- Li_2O lithium oxide
 CaH_2 calcium hydride

2006-J-4

- $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g})$
- 1.65 kg O_2 required; 1.36 kg CO_2 produced; 742 g H_2O produced

The law of conservation of mass states that mass may neither be created nor destroyed.
Mass of reactants = 0.454 kg propane + 1.65 kg O_2 = 2.10 kg
Mass of products = 1.36 kg CO_2 + 0.742 kg water = 2.10 kg
This combustion obeys the law (to 3 significant figures).

2006-J-5

- CH_4 is limiting reagent
1.39 kg H_2O remains

2006-J-6

- CH_2
 C_5H_{10}
- 0.050 mol
- 0.0750 M

2006-J-7

- exothermic
 -603 kJ mol^{-1}
- 0.025 M

2006-J-8

- $3\text{Ce}^{4+}(\text{aq}) + \text{Cr}(\text{s}) \rightarrow 3\text{Ce}^{3+}(\text{aq}) + \text{Cr}^{3+}(\text{aq})$
2.46 V
- It means that the reactants and products are all in their standard states (*i.e.* gases at 100 kPa, solutions at 1 M, elements in their most common form).

2006-J-9

- $-216.8 \text{ kJ mol}^{-1}$
 $\text{NaHCO}_3(\text{s}) + \text{H}^+(\text{aq}) \rightarrow \text{Na}^+(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$

2006-J-10

- 17.0 g
23 minutes
- $\text{Pb}(\text{s})$, $\text{PbSO}_4(\text{s})$ is the anode.
 $\text{Pb}(\text{s}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{PbSO}_4(\text{s}) + 2\text{e}^-$
 $\text{PbO}_2(\text{s})$, $\text{PbSO}_4(\text{s})$ is the cathode
 $\text{PbO}_2(\text{s}) + 4\text{H}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) + 2\text{e}^- \rightarrow \text{PbSO}_4(\text{s}) + 2\text{H}_2\text{O}(\text{l})$

2006-J-11

- 2.00 atm