Key to test #1
Average± standard deviation: 82± 32 (i.e. 54% ±21%)
Approximate grades: A ≥ 125 ; B ≥ 105; C ≥ 65; D≥ 45. Highest = 137/150

1) One postulate: all matter is composed of atoms. Predicted: The law of multiple proportions

2) ice is at the freezing point of water, therefore, T = 0°C ; It is useful to convert the other temperature values to the same unit, namely °C. For the unknown substance, melting point = (122-32)(5/9)= 50° C; Freezing point = 240-273 = -33 °C . Thus, at T=0°C the substance is between its freezing point and its melting point => it's a *liquid*.

3) Ice floats on water because the density of ice is less than that of liquid water. The complete melting of a floating ice cube in a glass of water would not change the level of the water in the glass. That is because the volume of the melted ice (i.e as liquid water) would be equal the exact volume it displaced when it was floating. (The mass of ice is the same after it melts.) How do we know? This is based on *Archimedes* principle.

4) FW = 63.55 + 2(54.94)+8(16.00) =301.43
#mol Cu = 2.5 g $Cu(MnO_4)_2$ x(1 mol/301.43)(1mol Cu/mol) =$8.3x10^{-3}$
#mol Mn = 2.5 g $Cu(MnO_4)_2$ x(1 mol/301.43)(2mol Mn/mol) = $1.7\ x10^{-2}$
#mol O = 2.5 g $Cu(MnO_4)_2$ x(1 mol/301.43)(8mol O/mol) = $6.6\ x10^{-2}$

5) Rutherford's experiment. He bombarded a thin gold foil with alpha particles and observed that a few of the dense particles actually bounced back showing a very dense small + region in the atom, called the nucleus.

6) AW = (10.013)(.405) + (11.009)(.355) + 12.017(1-.405-.355) = 4.05_5+3.90_8+2.88_4
=10.84_7 = 10.85

7) #p = 22, # n = 48-22 = 26, # e = 22-3 = 19

8) Emp. Formula of glucose and other carbohydrates = CH_2O:
EW = (12.0)+2(1.0)+16.0=30 g/mol;
If the MW = 240; then there are 240/30 = 8 empirical units within the formula and so:
$C_8H_{16}O_8$ would be the chemical formula.

9) relative uncertainty = $\Delta d/d = \Delta m/m + \Delta V/V$ = .05/1.55 + .5/21.0 = .03 +.02 = .05
(i.e. percent relative uncertainty = 5%)

10) # mol Cl = 1.121 g Cl x (1mol/35.45g) =.0316 mol Cl
#mol Ti = (1.500-1.121)(1mol /47.88g)=.00791 mol Ti
the ratio of Cl to Ti = .0316/.00791 = 3.99 ≈ 4 so, it's $TiCl_4$

11) Cr_2O_5 means that the total negative charges are -2(5) = -10 and so the total + charges from Cr must be +10. The charge of each Cr cation must be +5 and the total #e per Cr ion = 24-5 = 19 electrons

12) a) $(NH_4)_2CrO_4$ b) iron(III) hydrogencarbonate (*should have read: $Fe(HCO_3)_3$*), c) KNO_2

13) Assuming we have 100 g: mol C = 11.776 x (1 mol/12.00) = .9813 mol C
mol Cl = 69.578g x (1mol/35.45) = 1.963 mol Cl mol F = (100-11.776-69.578)g (1mol/19.00)=0.9813 mol F => $C_{.9813}Cl_{1.963}F_{.9813}$. Divide subscripts by 0.9813, and we get the empirical formula: CCl_2F, with an empirical weight of EW = 101.9
Since the molecular weight, MW = 203.8 => 203.8/101.9 =2 (there are 2 empirical units within the actual chemical formula => $C_2Cl_4F_2$