**THE OPEN UNIVERSITY OF SRI LANKA**
**B.Sc. Degree Programme / Stand alone courses 2006/2007**
**CHU 3129 – INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS**
**Answer guide to Assignment Test I**

1. Number of significant figures is given within brackets.

(i) (a) 5.10 **(3)** (b) 0.0014 **(2)** (c) $1.400 \times 10^5$ **(4)** (d) 1346 **(4)**

(ii) $\log(1.00 \times 10^8) = 8.000$

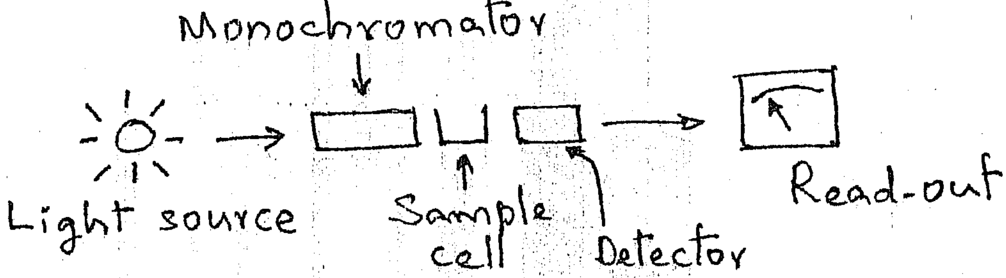
(iii) Light is emitted from an atom when an electron in a higher energy level falls into a lower one. The energy gap between the two levels is a constant value. When this happens energy is given off as photons having specific energies and therefore specific wavelengths. Only light of those wavelengths is observed giving rise to a line spectrum.

(iv) $A_1 = 0.38$ $C_1 = 0.075 \text{ mol dm}^{-3}$ $A_1 = \varepsilon C_1 l$

$A_2 = 0.26$ $C_2 = ?$ $A_2 = \varepsilon C_2 l$

$$\frac{A_2}{A_1} = \frac{\varepsilon C_2 l}{\varepsilon C_1 l} \Rightarrow C_2 = \frac{A_2}{A_1} x C_1 = \left(\frac{0.26}{0.38}\right) x\, 0.075 \ mol\, dm^{-3} = \underline{\underline{0.051\ mol\, dm^{-3}}}$$

(v)




(vi) (a) vacuum phototubes (b) photomultiplier tubes (c) photodiodes

2. (i)

$A = \log (I_o / I_f)$

(ii) $I_0$ is measured after inserting the blank solution into the sample cell and $I_f$ is measured after inserting the sample solution. In the case of a manual spectrophotometer we make the absorbance equal to zero after inserting the blank solution and then we measure the absorbance of the sample solution.

(iii) A diamagnetic molecule is a molecule having no unpaired electrons.

(iv) The function of the transducer is to convert light into an electrical signal.

(v) First we have to calculate the energy of a single photon by dividing the energy of one mole of photons by the Avagadro's number.

Energy of a photon = $(450 \times 10^3 \text{ J mol}^{-1}) / (6.023 \times 10^{23} \text{ mol}^{-1})$

$= 7.47 \times 10^{-19}$ J

Now we can calculate the wavelength of the photon.

$$E = h\nu \qquad c = \nu\lambda \quad \Rightarrow \quad E = \frac{hc}{\lambda} \quad and \quad \lambda = \frac{hc}{E}$$

$$\lambda = \frac{(6.626 x 10^{-34}\ Js)(2.998 x 10^{8}\ ms^{-1})}{7.47 x 10^{-19}\ J} = 2.659 x 10^{-7}\ m$$

$$\lambda \cong 2.66 x 10^{-7}\ m = 266 x 10^{-9}\ m$$

$$\lambda = 266\ nm$$

(vi) According to the Hund's rule, unpaired electrons in different orbitals prefer to have the same spin. Therefore the triplet excited state is somewhat lower in energy than the singlet excited state. Hence triplet excited state is more stable than the singlet excited state.

(vii) In atomic absorption spectroscopy we need to have maximum number of atoms in the ground state (to absorb light) whereas in atomic emission spectroscopy we need to have maximum number of atoms in the excited state (to emit light when those atoms come down to the ground state.