CHU 3237/Industrial Chemistry
Answer Guide for Assignment Test II

1. (a) i. Glass formation is a property of many oxides. Glasses have also been made from sulphides, fluorides and many other anionic consistent. Some of the best glass formers are the oxides of elements near silicon in the periodic table.

ii. B_2O_3, GeO_2, P_2O_5
solubility in the water -for most borate and phosphate glasses.
High cost -for germanium

b) i. glass -appearance of a solid, transparent of light, having random motions, but haven't a regular pattern of particles
liquid -having random motions of the particles
solid -there is a specific hard structure and not having random motions of the particles

ii. Refer pg-28 , figure 4.1 (Unit II)

c) i. silica -main ingredient of glass
fluxes -reduce the melting temperature of silica
stabilizer -overcome the problem of solubility of water glass

ii. there is a specific viscosity range correspond to a specific temperature range in which glass manufacturing techniques can be carried out successfully. In glass technology this viscosity range is referred as the working range.

iii. Refer pg-32, figure 4.3 (Unit II)
working range 104- 107.6

iv. annealing range is the temperature range in which glass is allowed for slow cooling in order to relieve the stress.

2. a) i. Motor -sand + cement
Concrete - sand + cement + stones

ii. flash set -is the very rapid setting of cement accompanied by high evolution of heat which makes the cement very hard to work and produces a low strength cement. It is linked with the presence of C_3A.
false set -the abnormal premature stiffening of cement within a few minute of mixing with water. No appreciable heat is evolved and remixing the cement paste until it sets in the normal manner and without a loss of strength.

b) i. C_2S, C_3S, C_4AF, C_3A

ii. $C_2S < C_3A = C_4AF < C_3S$
800 C° ⟶ 1450 C°

iii. $2C_2S + 5H \longrightarrow C_3S_2H_4 + CH$
$2C_3S + 7H \longrightarrow C_3S_2H_4 + 3CH$
$C_3S_2H_4$ – CSH gel
$C_3A + 6H \longrightarrow C_3AH_6$ (hydrogarnet)
$C_4AF \longrightarrow C_3(AF).6H$ (solid solution)

iv. $C_3A > C_3S > C_4AF > C_2S$

c) Gypsum helps control the hydration rate of C_3A. it does so by reacting with C_3A to give ettringite $C_6AS_3H_{32}$ (prevent the flash set) and then give other products depending on the amounts of gypsum added.
When molar ration (gypsum/ C_3A) is,

> 1 we get ettringite + monosulphoaluminate
= we get monosulphoaluminate
< 1 we get solid solution of C_4AS_{12} and C_4AS_{13}

In the presence of excess gypsum, the ettringite becomes stable and the reaction between C_3A and sulphate (in gypsum) will continue after the cement has set. The continued reaction can cause cracking of the set cement.

3. a) i. Passivation –When a metal is place in a solution containing an oxidizing agent, corrosion does not occur (e.g, iron in con.HNO_3), this is because of formation of non-porous and insoluble oxide film with con.HNO_3. Such a protection of a surface – passivation.
Corrosion inhibitors - Corrosion inhibitors are compounds which can slow down corrosion when added in low concentration to the solution in which the metal is.

ii) Throwing power of a plating bath is the ability of the plating bath to give an even deposition the cathode.
Conductivity of the electrolyte
Tafel slope for deposition
Competing electrode reactions

b) Refer pg-18 figure-7 (Unit III)

c) i.

- Crevice corrosion
- Corrosion between two metal plates
- Pitting corrosion
- Stress cracking corrosion
- Corrosion by differential aeration

ii. Adsorption on metal surface (reduce the rate of either/both anodic or cathodic processes). Formation of passive layer

d. i) metal finishing –is a process where the surface of a metal is modified by electro-chemical method.

ii) E.g, by deposition of another metal layer (electroplating), formation of oxide film (anodizing) and deposition of conducting polymer layer (electro phoretic printing)