

CME2007 Process Design 1 Assignments (Process Utilities Part)

(to be handed in by 16th November 2007)

1. A type of biocide is effective at preventing biofilm growth in cooling water system at concentrations above 10 mg/l.

- i. If the maintenance routine for an open evaporative/recirculating cooling water system calls for biocide treatment once every 30 days, how much should a single dose be? (Hint: at the end of a 30 day period, $C(t)=10$ mg/l, work out $C(0)$ at the beginning of the period, then work out how much is a single dose.)

Water temperature at cooling water inlet	= 60°C
Water temperature at cooling water outlet	= 20°C
Cooling water rate	= 40m ³ /hr
Concentration factor	= 3.2
Volume of cooling water system	= 200m ³

- ii. By how much would the usage of biocide over a 30 day period be reduced if maintenance were carried out every 15 days?

2. Give the meaning of:

- a. Concentration factor
- b. System half life

In the context of an open evaporative system, assuming negligible windage losses, process leaks and with a “blow down” flow of 20 m³/hr, estimate the concentration factor and the half life for the following open evaporative system:

Capacity	1000 m ³
Cooling water circulation rate	4000 m ³ /hr
Water feed, return temperatures	20, 30°C

3. How and why are steam traps used in the distribution of steam? Sketch and describe the operation of a thermostatic and a mechanical type steam trap.

4. What is power factor and why is it so important in electrical services?

The load taken from a plant single phase electrical supply consists of:

- (a) a lighting load of 10 kW
- (b) a motor load of 80 kVA at 0.8 power factor lagging
- (c) a motor load of 40 kVA at 0.7 power factor lagging

Calculate:

- (i) the total load taken from the supply in kW and in kVA
- (ii) the power factor of the combined load