

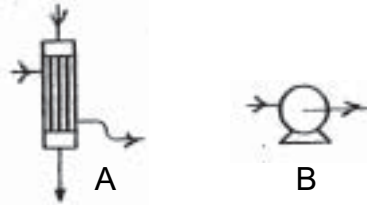
Chemical Engineering Test for Chapter 7

Time allowed 20 minutes

1 (a) When scaling up from pilot plant scale to full operational scale, why is there a problem with exothermic reactions ? (2)

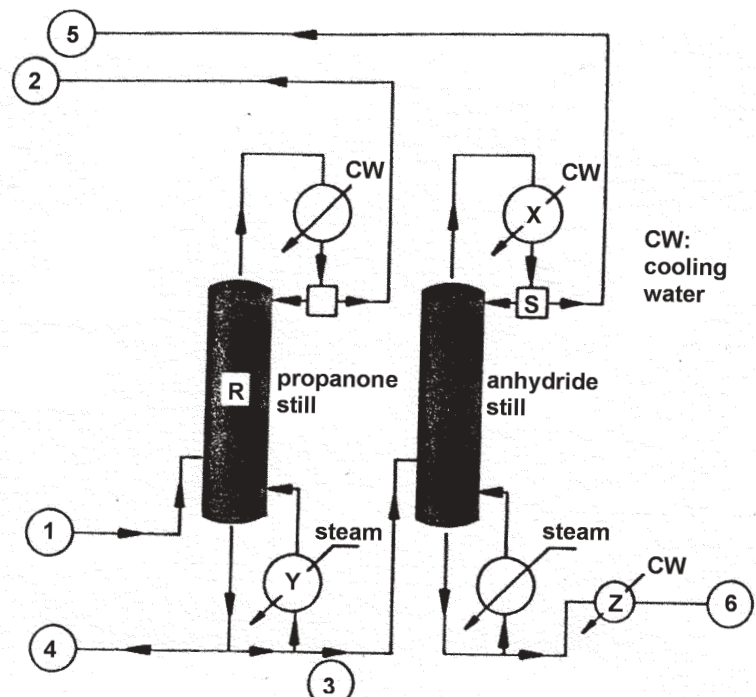
(b) Many industrial chemical plants are constructed of mild steel. Give **one** advantage and **one** disadvantage of the use of this material. (2)

(c) In a flow chart for a process, what items of equipment are represented by the following? (2)



2 Ethanoic anhydride, $(\text{CH}_3\text{CO})_2\text{O}$, can be made industrially starting from propanone and ethanoic acid. The diagram on the right shows the propanone and anhydride stills for such a plant. The function of the propanone still is to remove propanone from the product stream. The function of the anhydride still is to remove ethanoic acid from the product stream.

The table shows the partially completed associated mass balance in which all flow data are in kg hr^{-1} .



Component	1	2	3	4	5	6
	Feed to propanone still	Propanone recycle	Feed to anhydride still	Anhydride recycle	Ethanoic acid recycle	Anhydride product
Propanone	6641	6621	14	A	14	D
Ethanoic	3786	1	2636	B	2495	E
Anhydride	3786	0	2635	C	9	F

(a) Complete the mass balance to obtain flow values for A, B, C, D, E and F. (3)

(b) What is the percentage purity of the ethanoic anhydride produced by the plant? (1)

(c) What is the name or function of item S ? (1)

(d) Why are stream flows 2 and 5 recycled? (1)

(e) X, Y and Z are all heat exchangers. There is a different reason for using each of these.

What is the reason in each case? (3)

Total 15 marks

Chemical Engineering Test for Chapter 7 Answers

1 (a) Volume increases more than surface area (1) danger of uncontrolled temperature rise (1)

(b) Advantage: cheaper than most other materials (1)
Disadvantage: poor corrosion resistance (1)

(c) A is heat exchanger (1) B is a pump (1)

2 (a) A 6
 B 1149
 C 1151
 D 0
 E 141
 F 2626 (3)

(b) 94.9% (1)

(c) reflux divider *or* returns some distillate to the column (1)

(d) because these contain significant amounts of unchanged reactants and are sent back to the reactor (1)

(e) X condenses the vapour from the top of the column and sends the resulting liquid to the reflux divider (1)

Y takes liquid from the feed to the anhydride still and vaporises it ready to be put back into the propanone still (1)

Z cools the anhydride stream preparatory to storage (1)

Total 15 marks