Solution

CADET _____ SECTION _____TIME OF DEPARTURE _____

DEPARTMENT OF CHEMISTRY & LIFE SCIENCE

QUIZ 1 – CH402 2023-2024
10 Minutes, 24 Points
22 February 2024

TEXT: Peters, Timmerhaus, & West
SCOPE: Chapter 6

References Permitted: FE Reference Manual online.

INSTRUCTIONS

1. There are 4 problems on 1 page in this quiz (not including the cover page or supplements).
2. You will have 10 minutes for the quiz.
3. Do not mark this quiz until "begin work" is given.
4. Circle the correct answer to receive full credit.

(TOTAL WEIGHT: 24 POINTS)

DO NOT WRITE IN THIS SPACE

PROBLEM	VALUE	CUT
A	6	d
B	6	b or a
C	6	d
D	6	c
TOTAL CUT		
GRADE	24	

Solution

Cadet:_____

Problem:	Weight:
A	6

The delivered equipment cost for a solid-fluid processing plant is $250,000. On average, the fixed-capital investment for the plant is most nearly

(a) $610,000
(b) $760,000
(c) $860,000
(d) $1,100,000

Use ranges from page 257 of the FE manual for FCI

$\frac{387+483}{2} = 435\%$ or 4.35 (average)

$4.35 \times 250{,}000 = \$1{,}087{,}500 \cong \$1{,}100{,}000$

ANS (d)

Problem:	Weight:
B	6

Using Lang Factors, $4.3 \times 250{,}000 = \$1{,}075{,}000 \cong \$1{,}100{,}000$ ANS

The delivered equipment cost for a solid-fluid processing plant is $250,000. On average, the working capital for the plant is most nearly

(a) $180,000 or
(b) $190,000
(c) $240,000
(d) $310,000

Use ranges from page 257 of the FE manual for WC

$\frac{.86+.68}{2} = .77$ (average)

$.77 \times 250{,}000 = \$192{,}500 \cong \$190{,}000$

ANS (b)

Problem:	Weight:
C	6

Using Lang Factors, $(5.0-4.3) \cdot 250000 = \$175{,}000 \cong \$180{,}000$

ANS (a)

A six-foot stainless-steel bubble-cap tray cost $1,850 in 1999. Estimate the cost of a similar ten-foot tray in 2020. The chemical engineering price index factors are 435.5 and 764.7 for 1999 and 2020, respectively.

(a) $1,800
(b) $3,400
(c) $5,000
(d) $6,000

Using scaling factors from page 258 of the FE manual

$\$1850 \cdot \left(\frac{10}{6}\right)^{1.2} \cdot \frac{764.7}{435.5} = \$5896 = \$6000$

ANS (d)

Problem:	Weight:
D	6

A fixed-tube-sheet shell-and-tube heat exchanger with an area of 120 m^2 cost $12,800 in 2006. What is the cost of a similar heat exchanger with an area of 300 m^2 in 2020? The chemical engineering price index factors are 548.0 and 650.1 for 2006 and 2020, respectively.

(a) $22,181
(b) $19,156
(c) $22,725
(d) $26,313

Use scaling factors from page 258 of the FE manual

$\$12{,}800 \cdot \left(\frac{300}{120}\right)^{.44} \cdot \left(\frac{650.1}{548.0}\right) = \$22{,}725$

ANS (c)