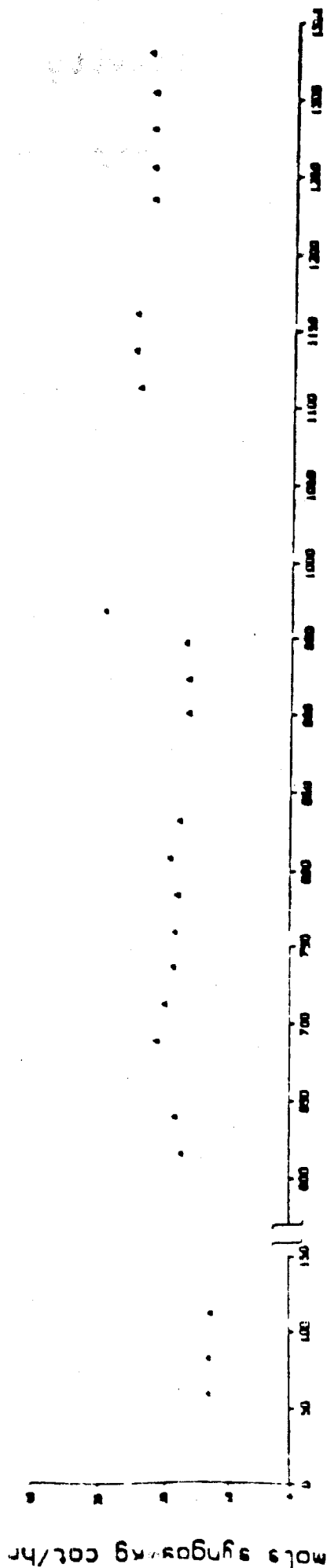


Figure 1

7595-60-C48.4

Bulk Activity vs. Time on Stream



Hrs on Stream

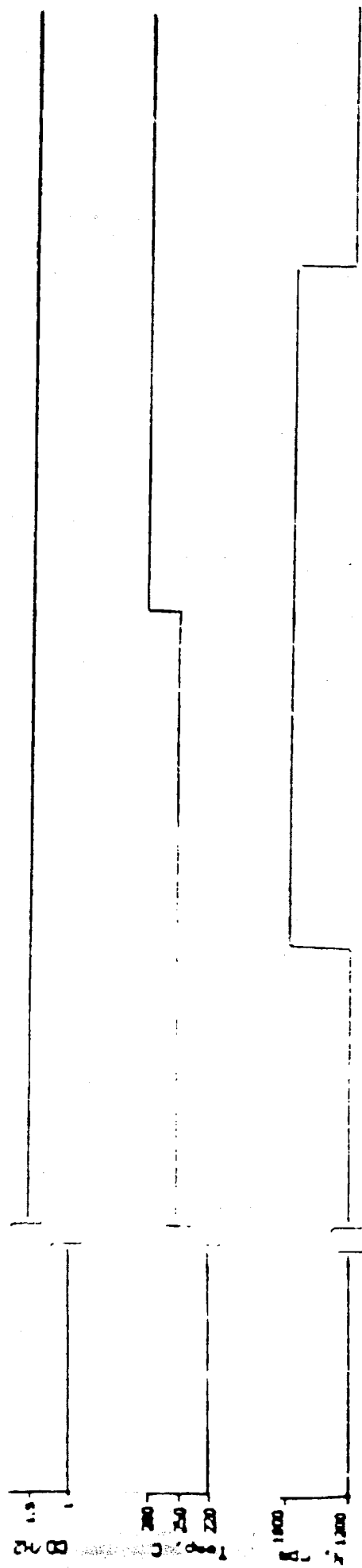


Figure 2
7595-60-C48.4

Hydrocarbon Selectivity

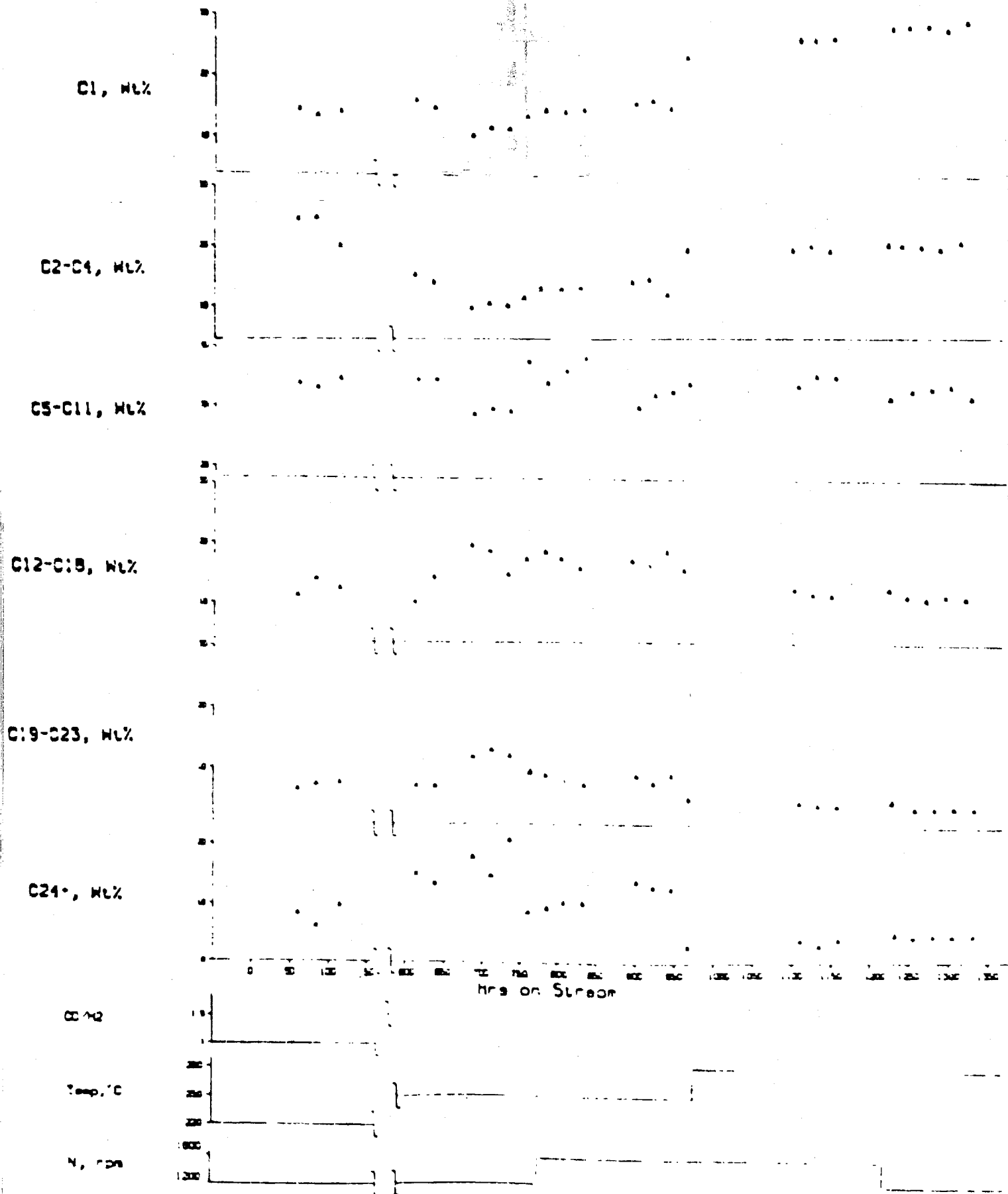


FIGURE 3

HYDROCARBON WEIGHT DISTRIBUTION

7595-60-C48.4-4

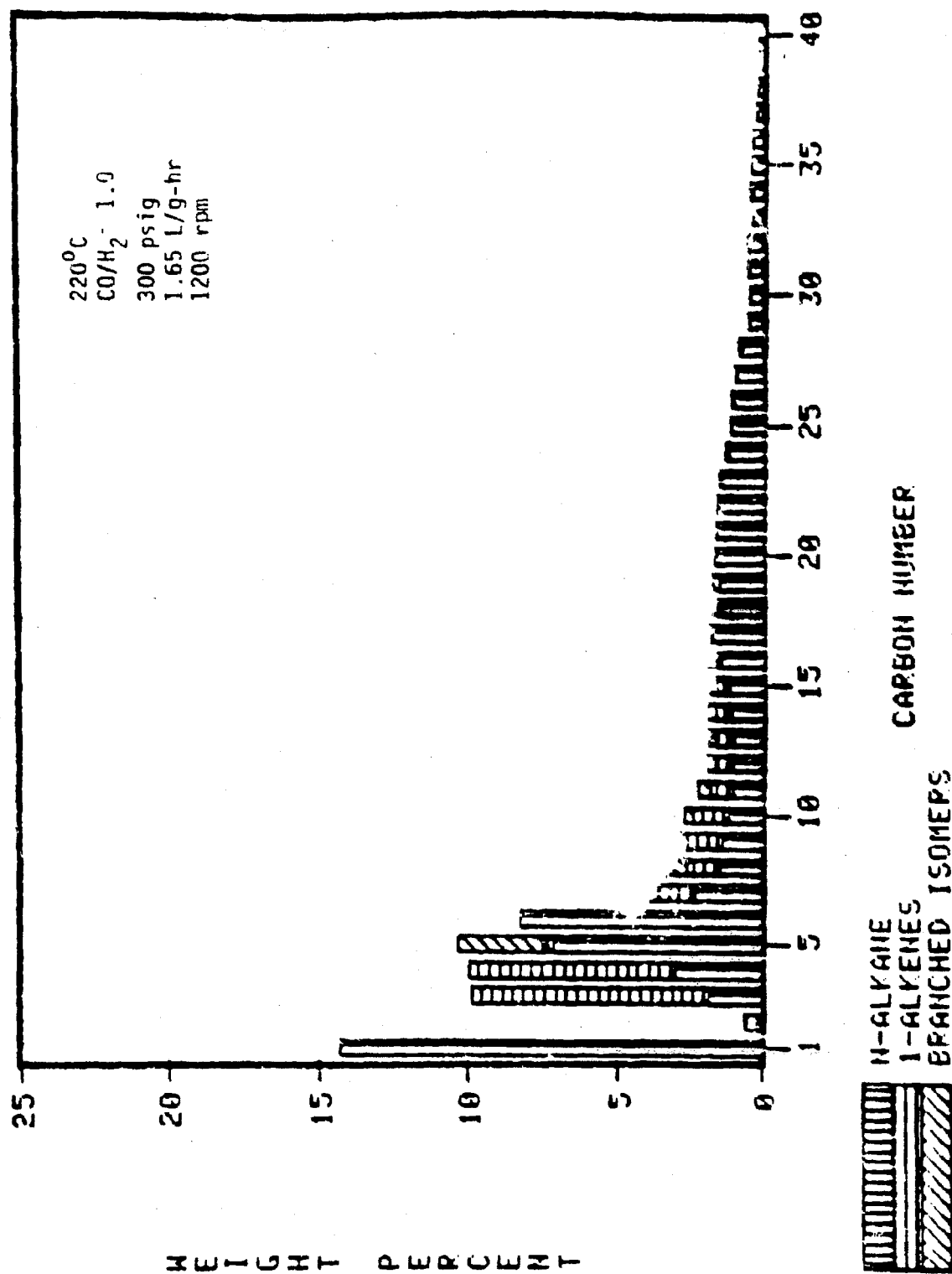


FIGURE 4
HYDROCARBON WEIGHT DISTRIBUTION
7595-60-C48.4-38

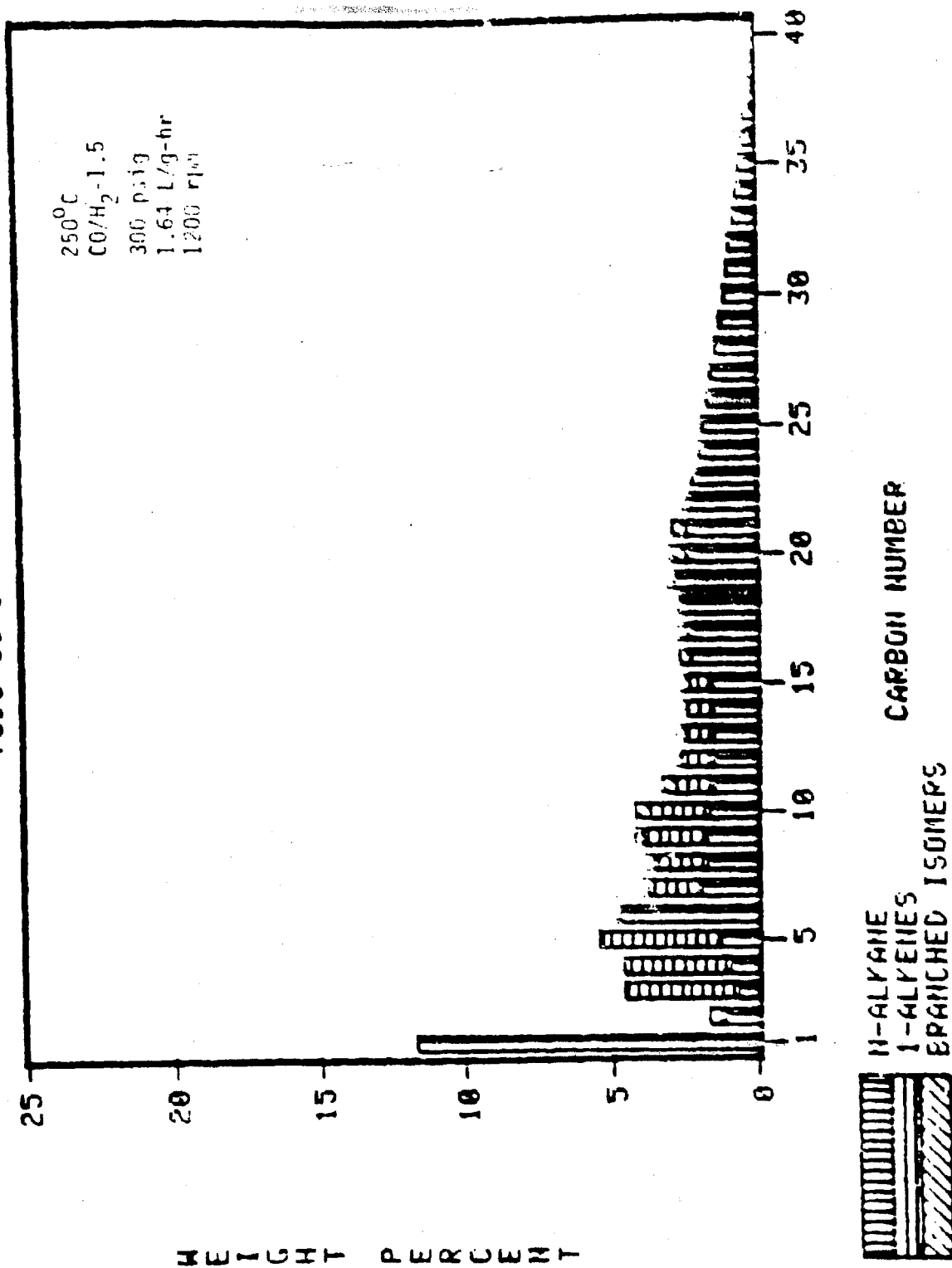


FIGURE 5

HYDROCARBON WEIGHT DISTRIBUTION

7595-60-C43.4-66

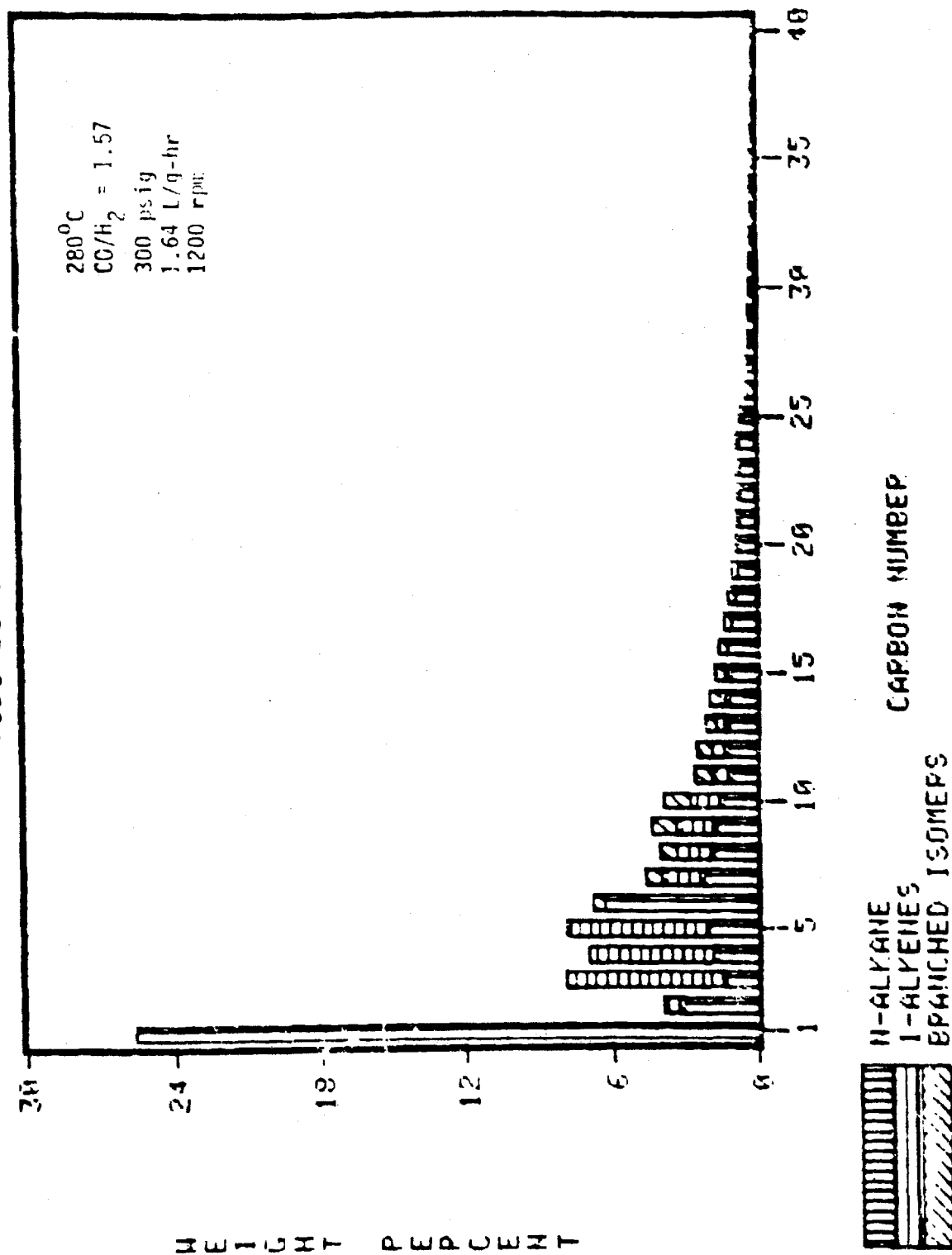


FIGURE 6

HYDROCARBON PRODUCT DISTRIBUTION

- APC1, $\text{Co}_2(\text{CO})_8/\text{Zr}/\text{SiO}_2$
- SHELL, $\text{Co}(\text{C}_5\text{H}_5)_2/\text{Zr}/\text{SiO}_2$

(FIXED-BED, 240°C , $\text{CO}/\text{H}_2=1$, 1000 hr^{-1} , 500 PSIG)

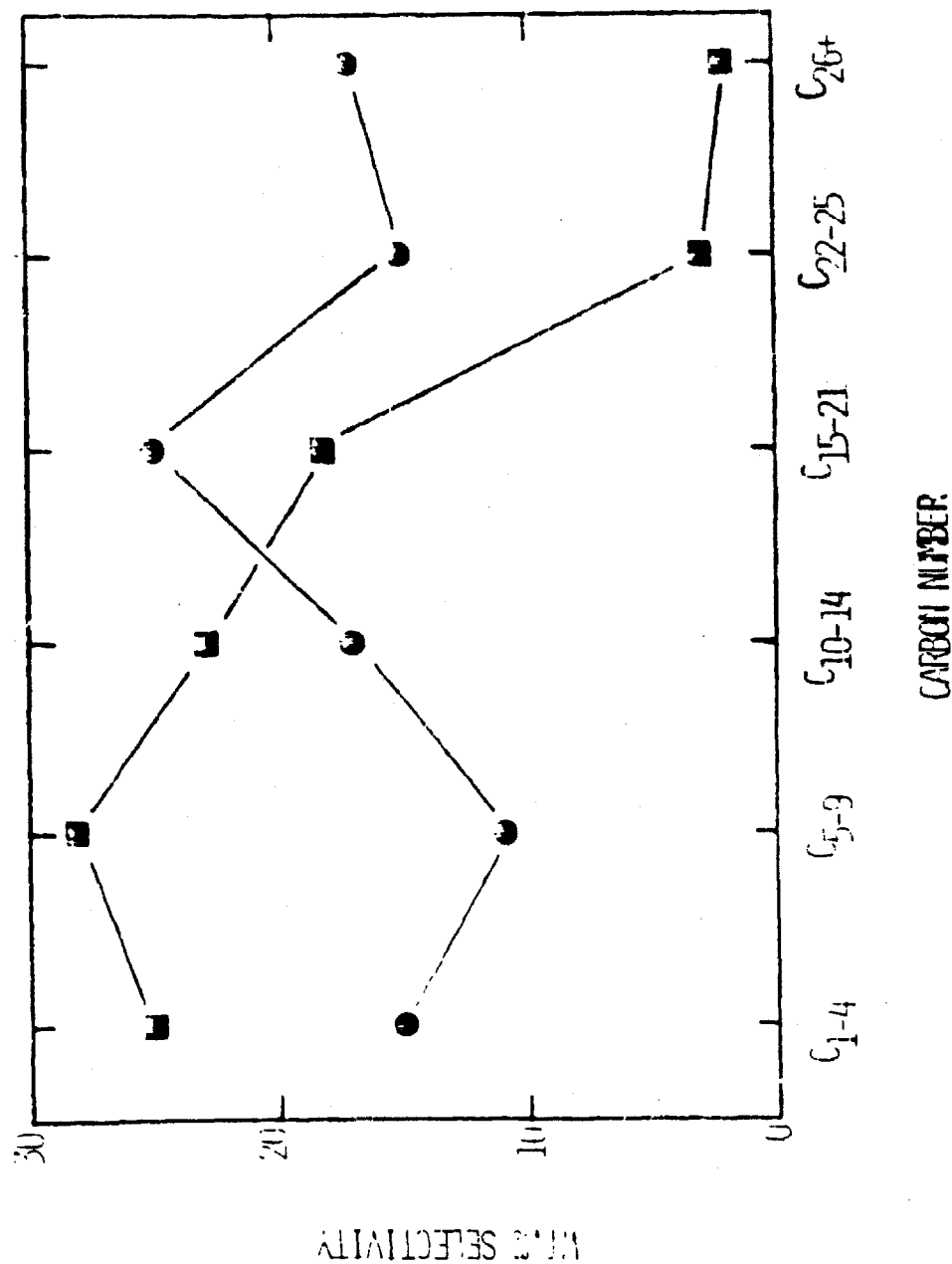


FIGURE 7

EFFECT OF SYNGAS VS. HYDROGEN ACTIVATION ON CONVERSION

4 Co ON Zr/Al_2O_3 -- SLURRY PHASE

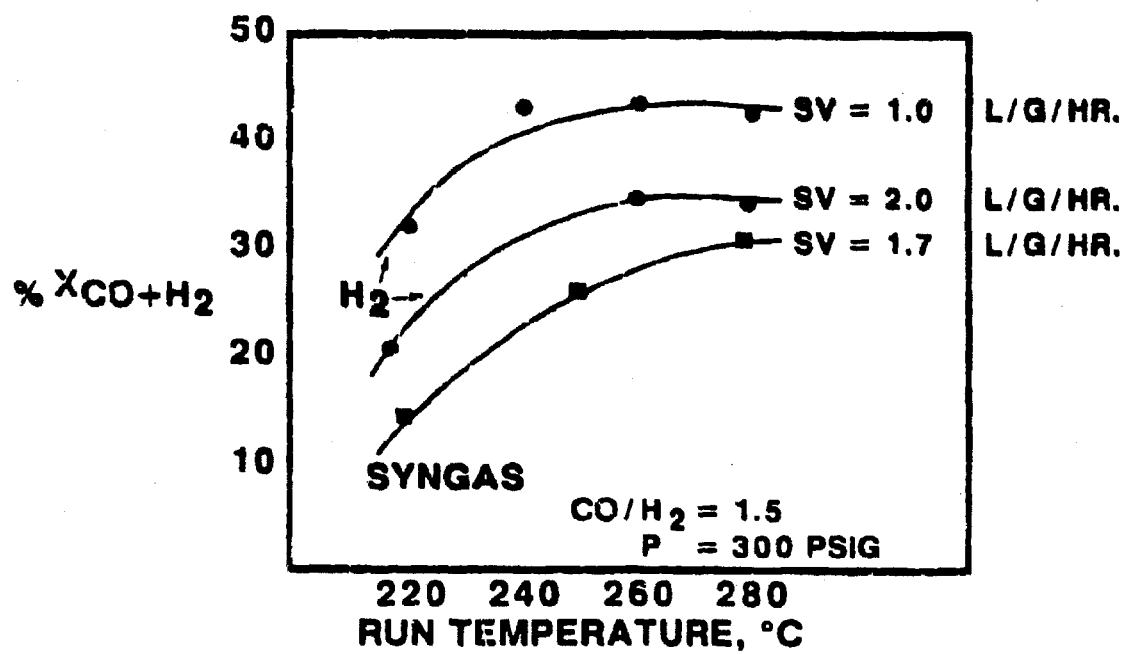


FIGURE 8
EFFECT OF SUPPORT ON ACTIVITY OF $\text{Co}_2(\text{CO})_8$ - BASED CATALYSTS
(FIXED-BED REAC.)

240°C, $\text{CO}/\text{H}_2 = 1.0$, $\text{GHSV} = 1000 \text{ HR}^{-1}$, 300 PSIG

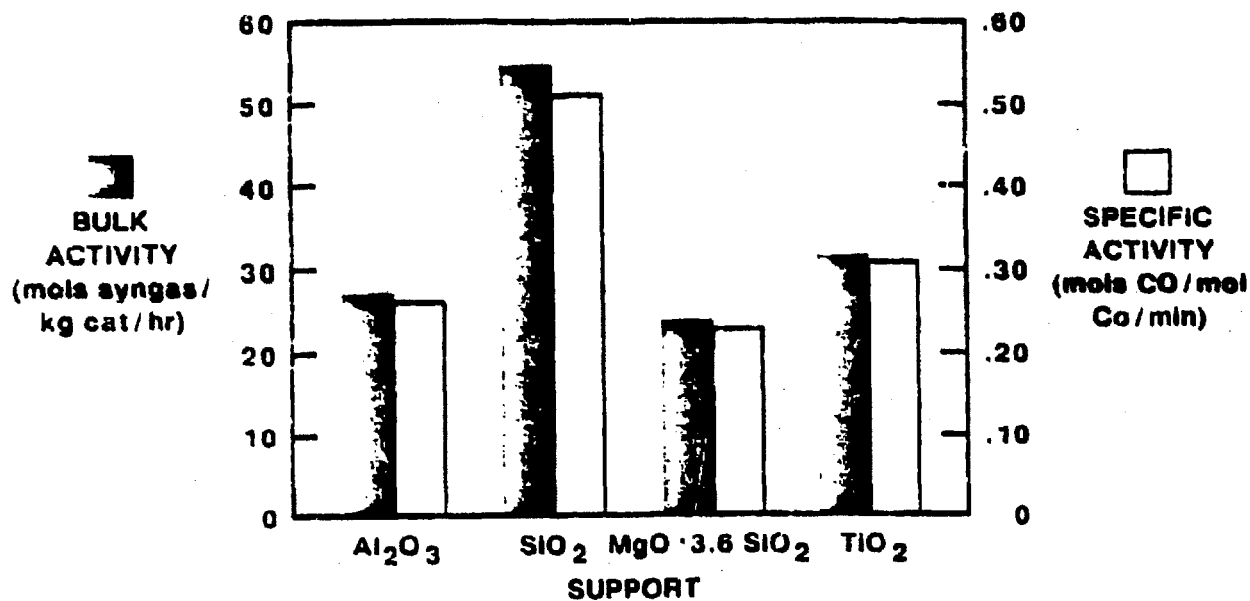


FIGURE 9

EFFECT OF SURFACE AREA

(Fixed-Bed Reactor - $\text{CO}/\text{H}_2=1$, 1000 hr^{-1} , 300 psig)

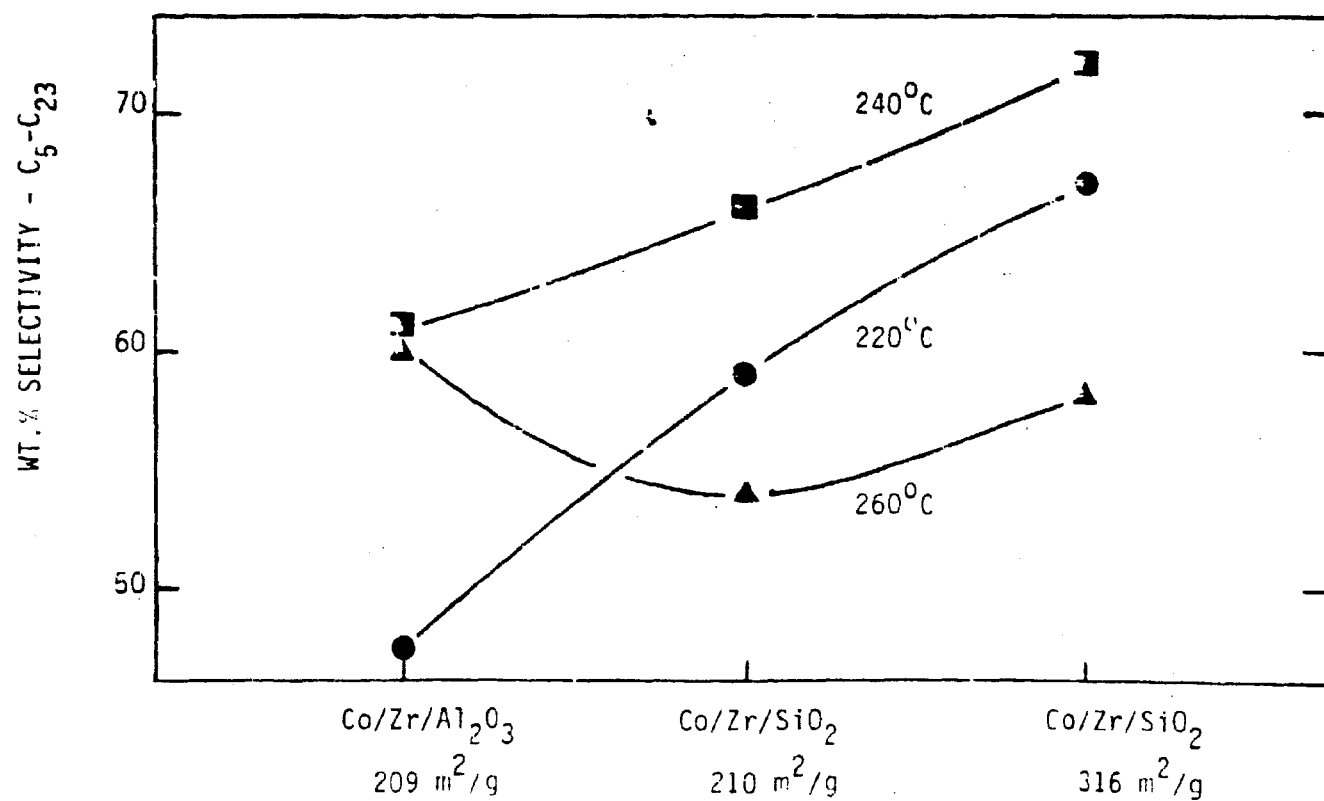
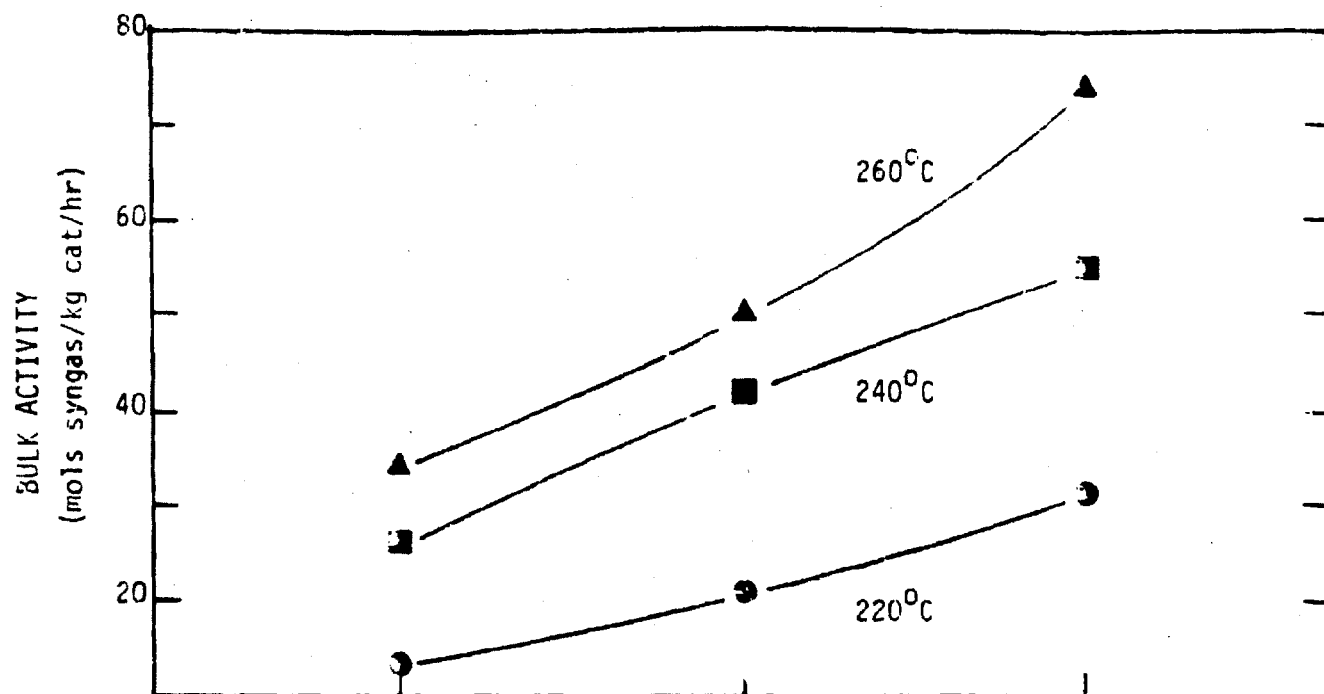


FIGURE 10

Effect of Co/Zr Ratio on Bulk Activity
(Gas Phase -- $\text{CO}/\text{H}_2=1$, $\text{SV}=1000 \text{ hr}^{-1}$, 300 psig)

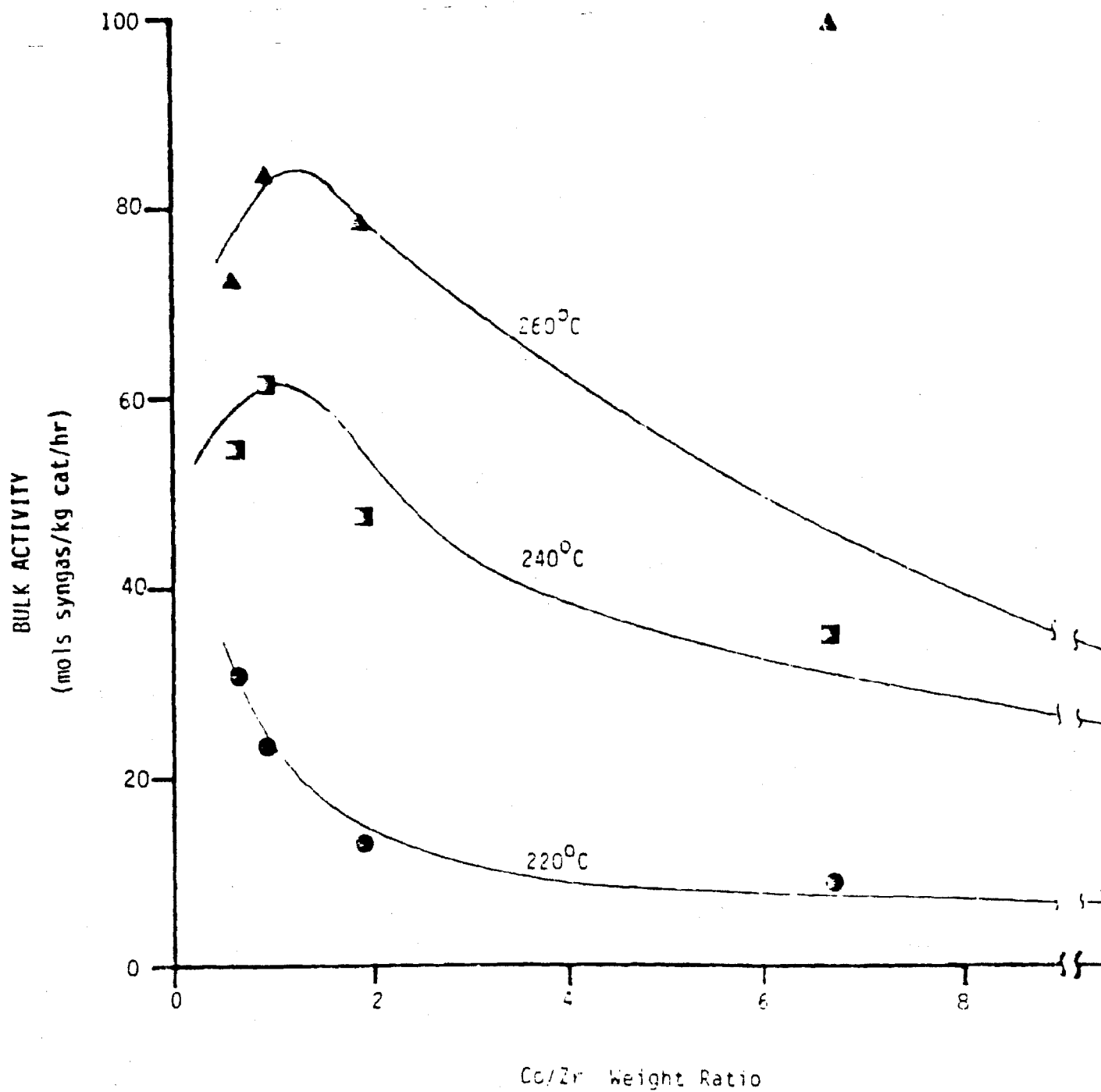


FIGURE 11

Effect of Co/Zr Ratio on Specific Activity

(Gas Phase -- $\text{CO}/\text{H}_2=1$, $\text{SV}=1000 \text{ hr}^{-1}$, 300 psig)

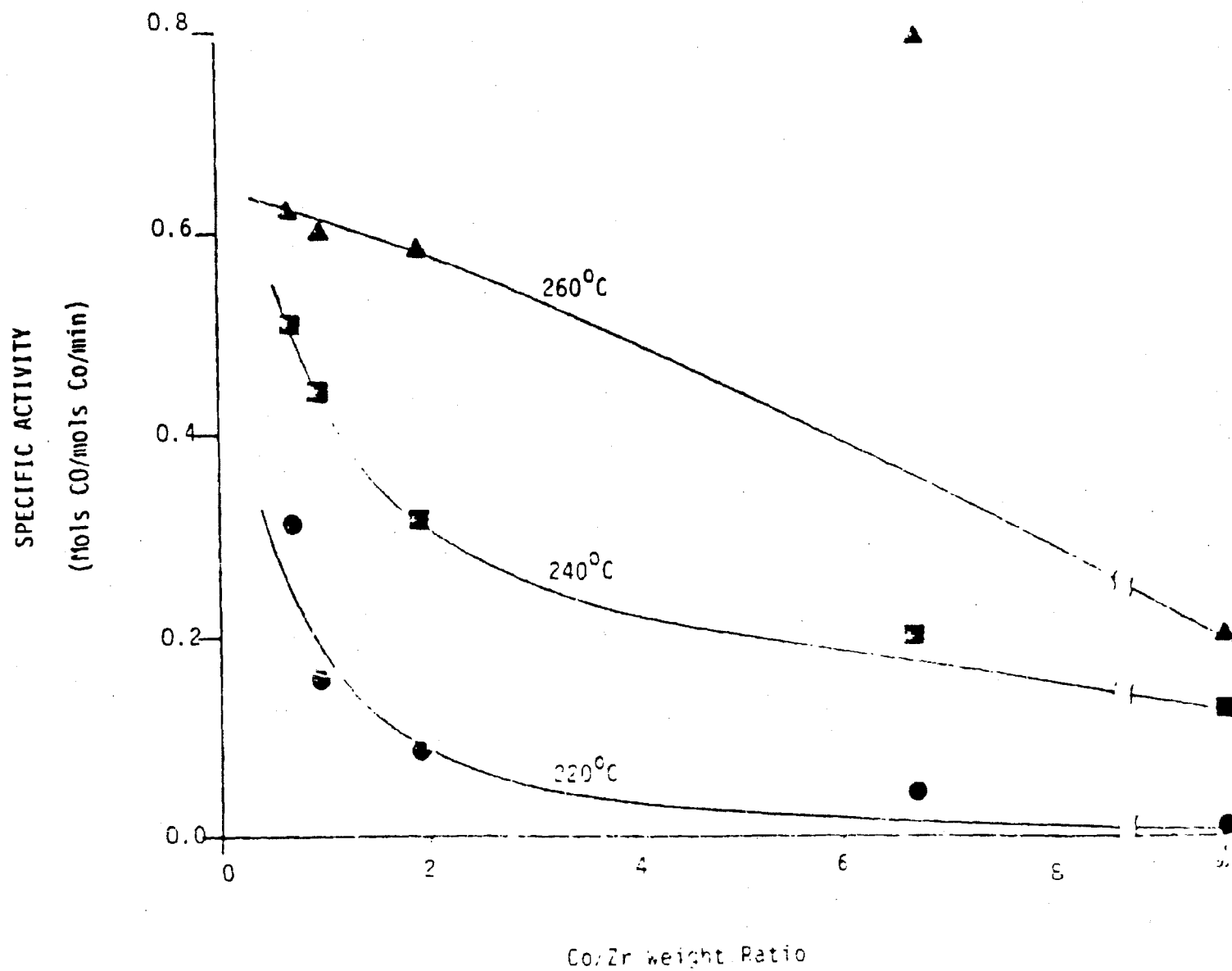


FIGURE 12

EFFECT OF Co/Zr WEIGHT RATIO ON SLURRY-PHASE ACTIVITY OF
Co/Zr/SILICA CATALYSTS

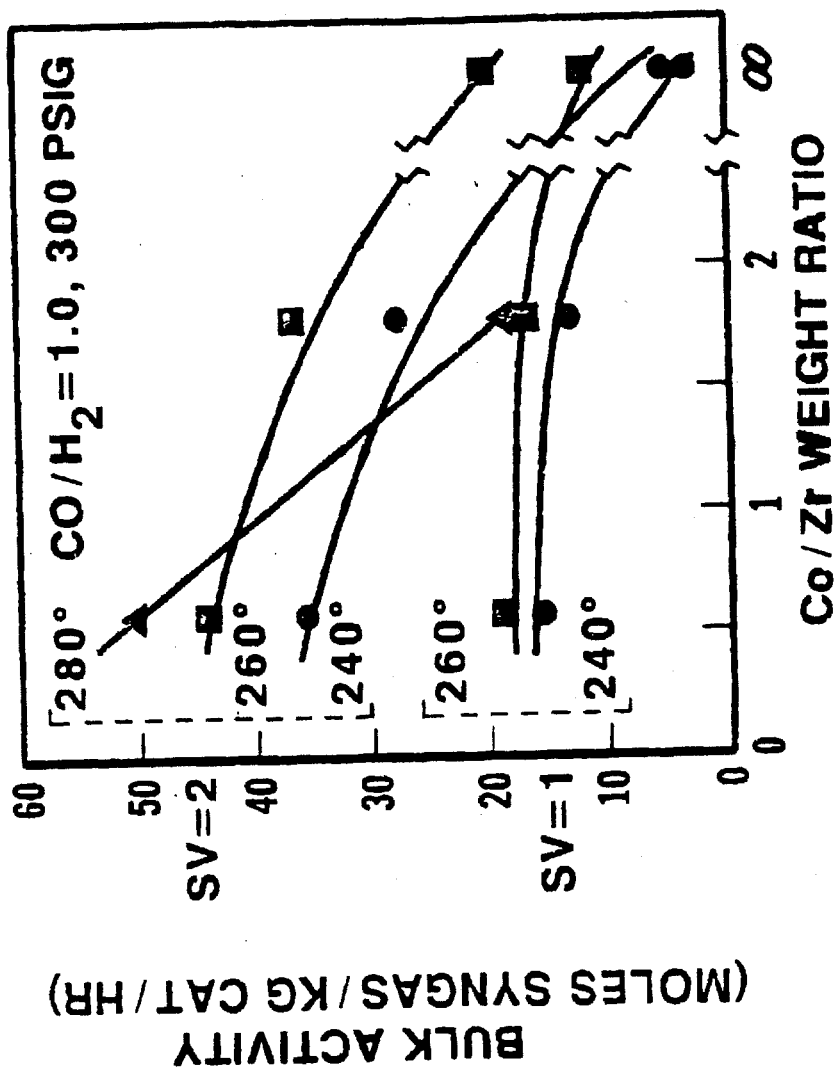


FIGURE 13

EFFECT OF COBALT LOADING ON
BULK ACTIVITY OF Co/Zr/SiO_2 CATALYST
(Fixed Bed Reactor - $\text{CO/H}_2=1$, 1000 hr^{-1} , 300 psig)

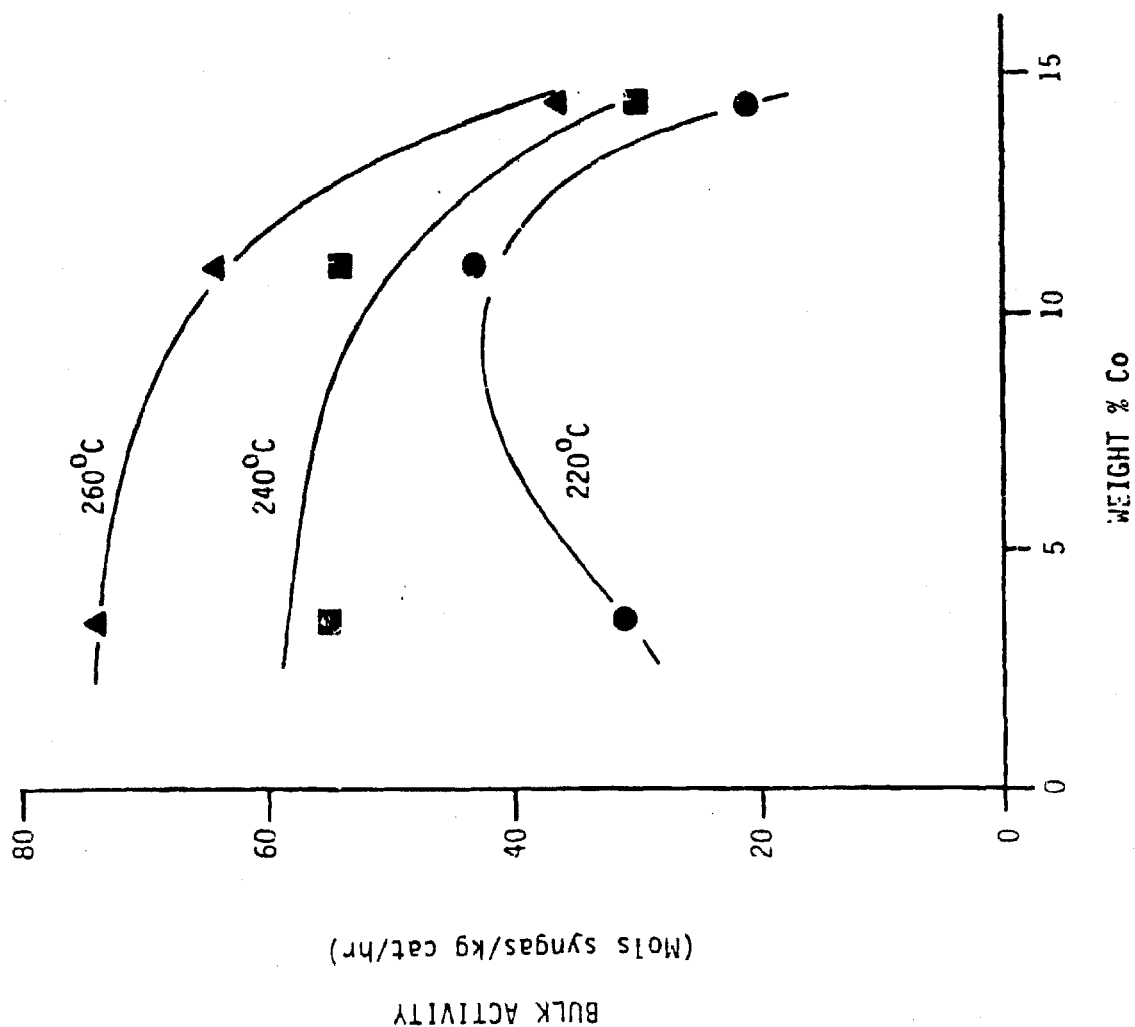


FIGURE 14

EFFECT OF Co LOADING ON Co/Zr/SiO₂ PERFORMANCE
- SLURRY REACTOR -

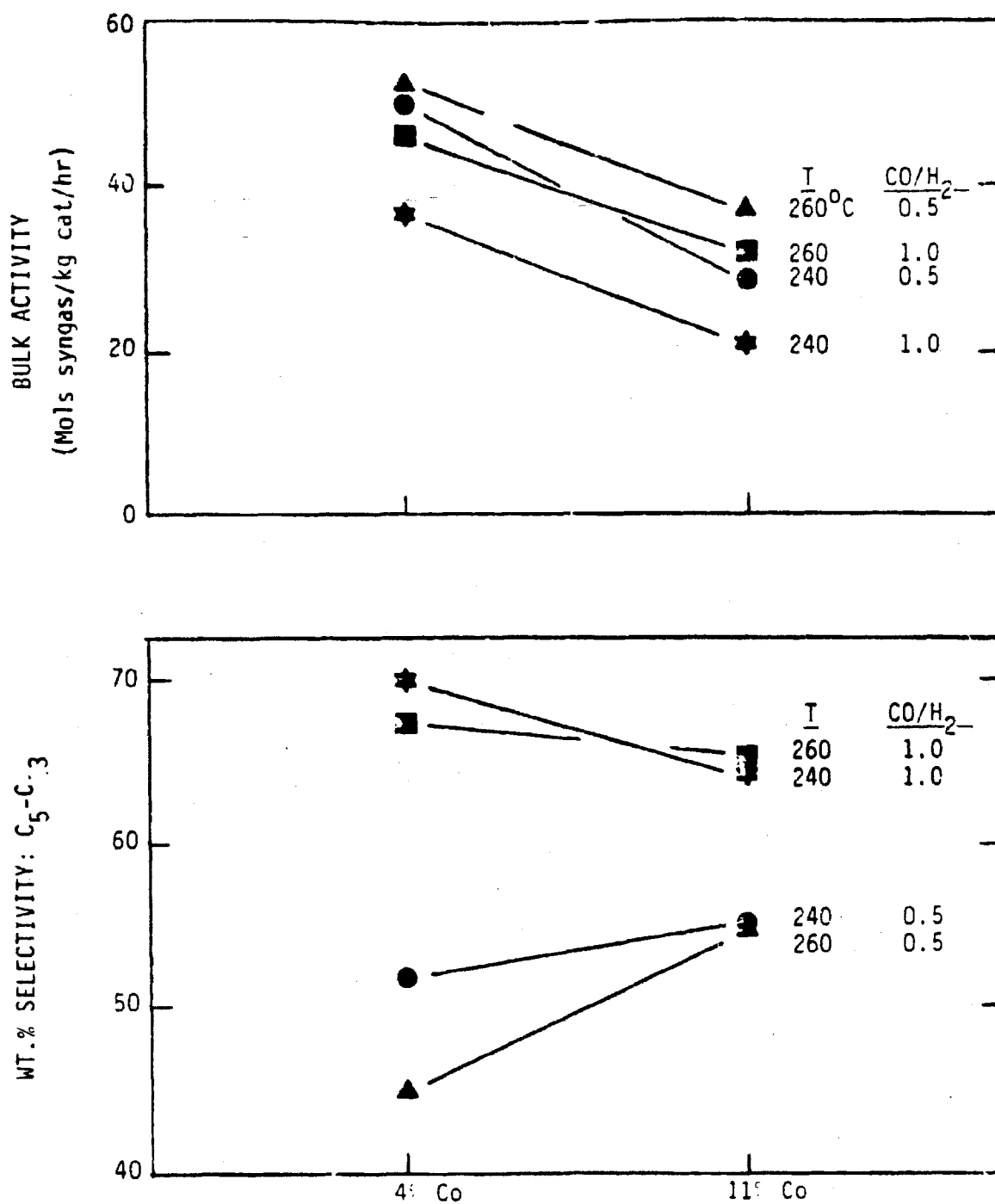


FIGURE 15

WATER - GAS SHIFT ACTIVITY

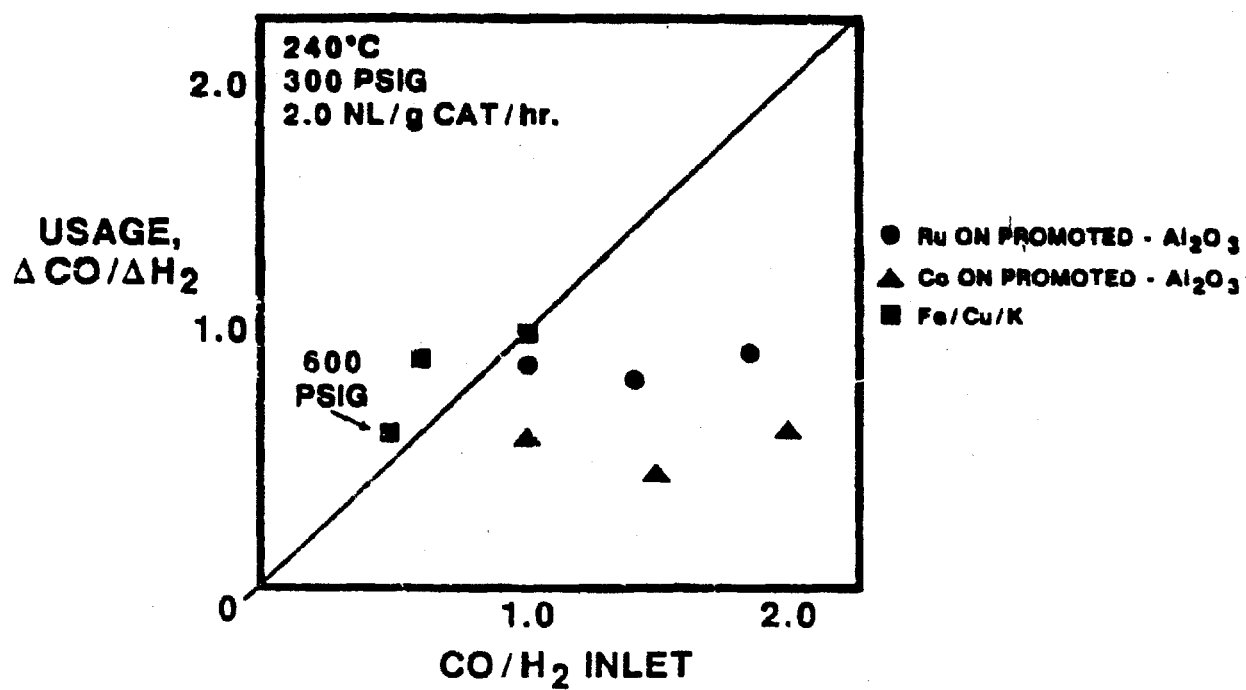


FIGURE 16

Bulk Activity Maintenance--Extended Slurry Test 8862-1-31
 Co/Zr/SiO₂, 240°C, CO/H₂ = 0.5, 1.8 L/g/hr, 300 psig

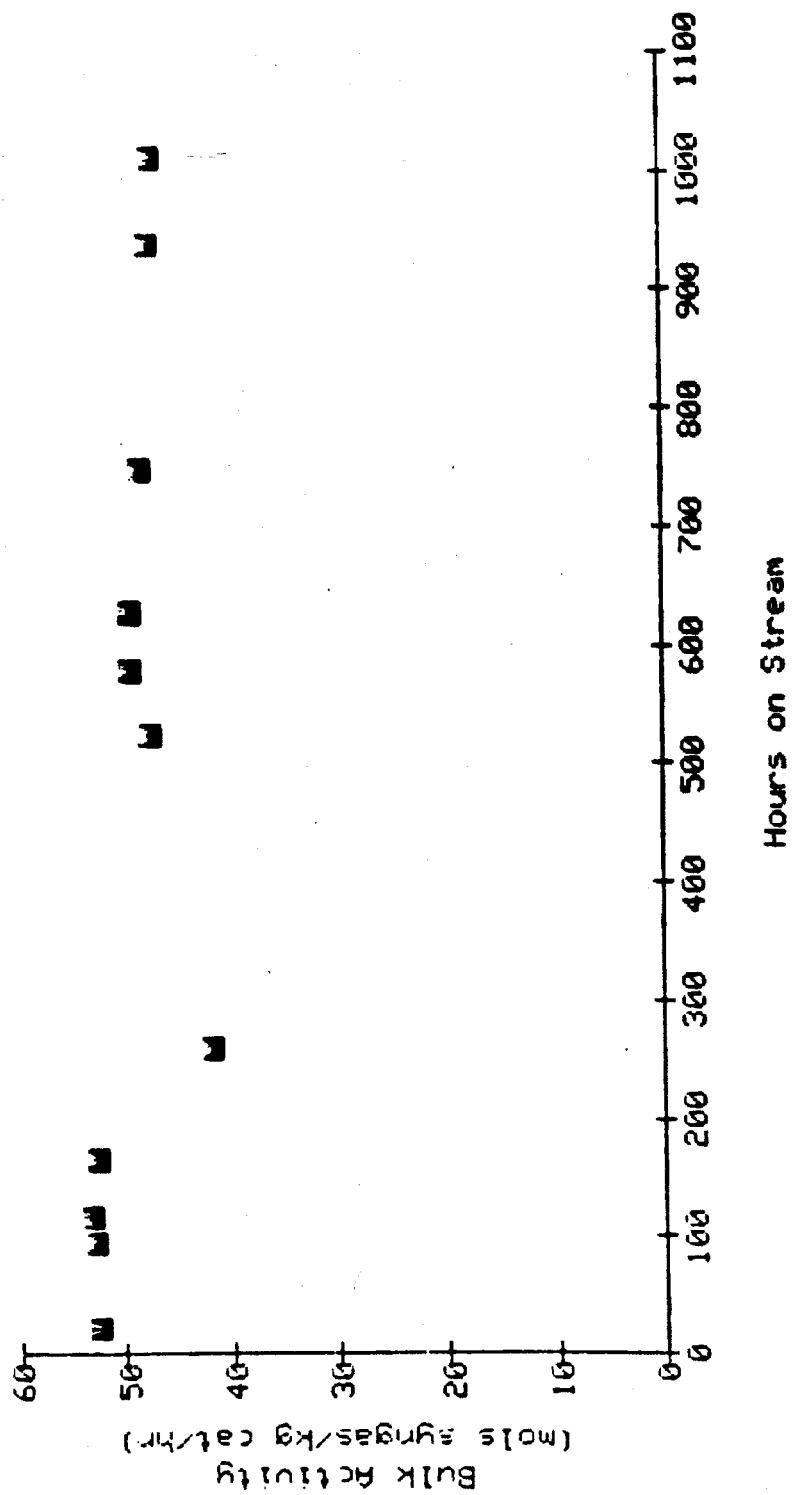


FIGURE 17

Conversion Maintenance--Extended Slurry Test 8862-1-31
 Co/Zr/SiO₂, 240°C, CO/H₂ = 0.5, 1.8 L/g/hr, 300 psig

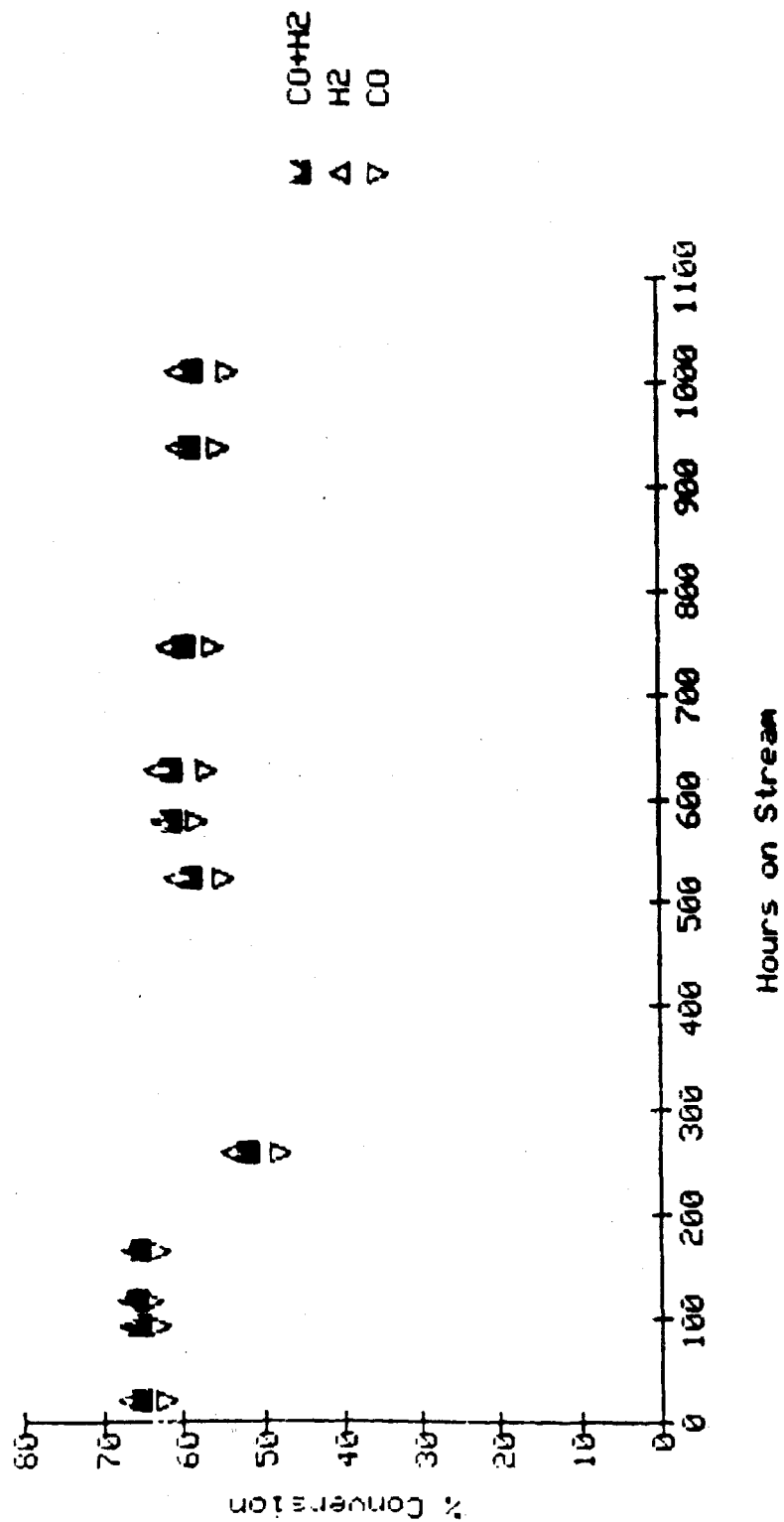


FIGURE 18

Hydrocarbon Selectivity--Extended Slurry Test 8862-1-31
 Co/Zr/SiO₂, 240°C, CO/H₂ = 0.5, 1.8 L/g/hr, 360 psig

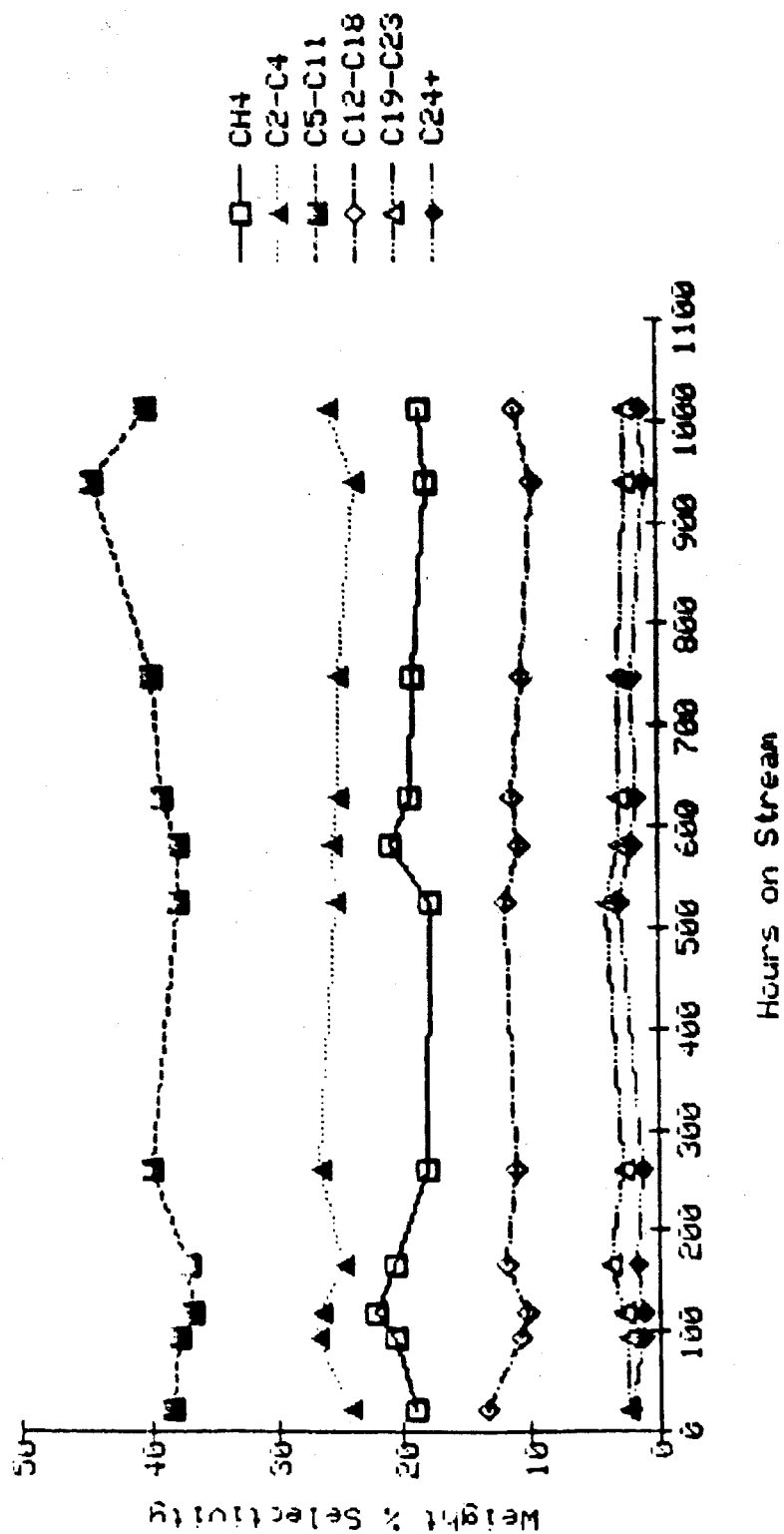


FIGURE 19

Bulk Activity Maintenance--Extended Slurry Test 8862-1-31
 Co/Zr/SiO₂, 260°C, CO/H₂ = 1.0, 2.0 NL/g/hr, 300 psig

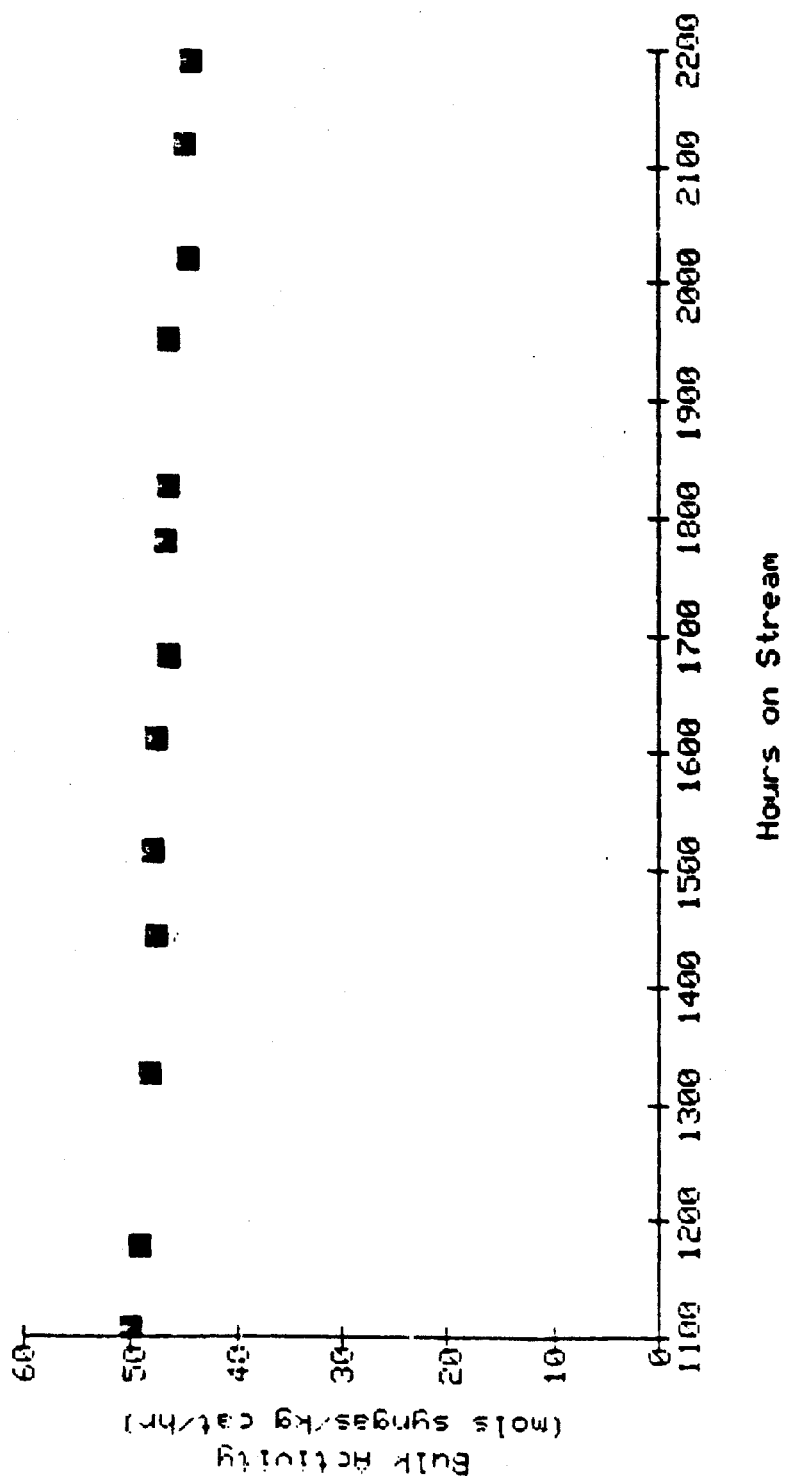


FIGURE 20

Conversion Maintenance--Extended Slurry Test 8862-1-31
Co/Zr/SiO₂, 260°C, CO/H₂ = 1.0, 2.0 NL/g/hr, 300 psig

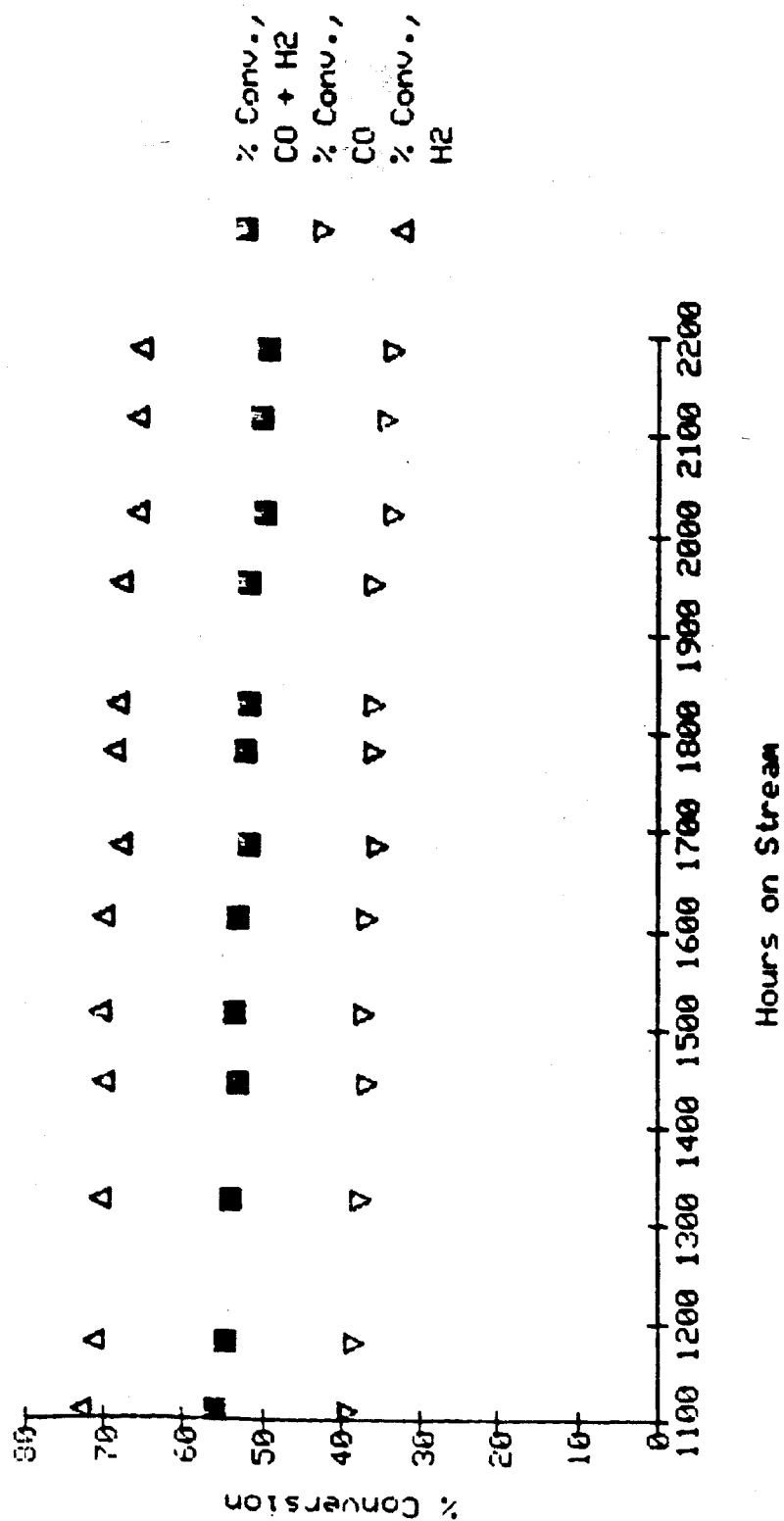


FIGURE 21

Hydrocarbon Selectivity-Extended Slurry Test 8862-1-31
 Co/Zr-SiO₂, 260°C, CO/H₂ = 1.0, 2.0 HL/g/hr, 360 psig

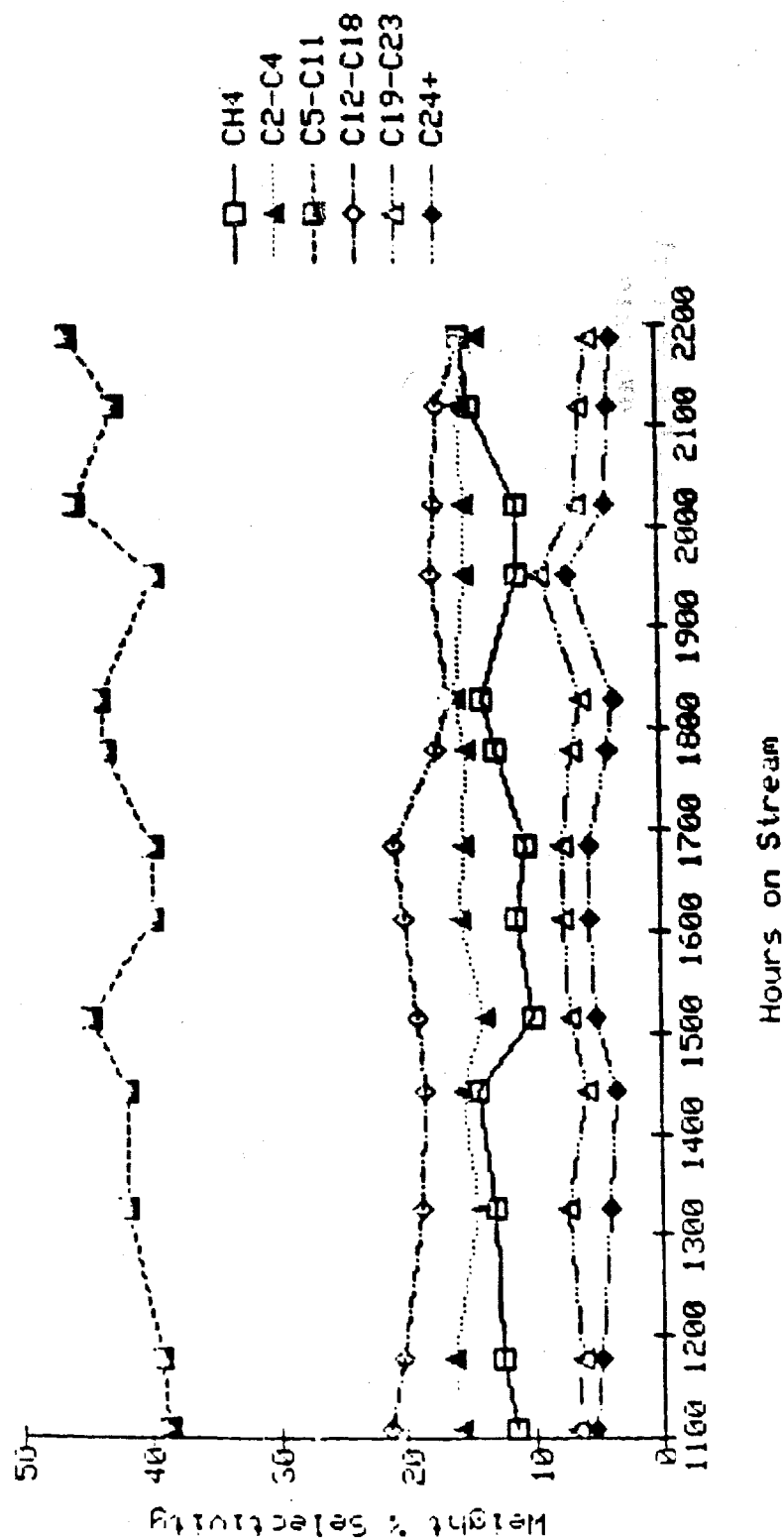


FIGURE 22

Bulk Activity Maintenance--Extended Slurry Test 8862-1-31
 Co/Zr/SiO₂, 260°C, CO/H₂ = 1.0, 2.0 mL/g/hr, 300 psig

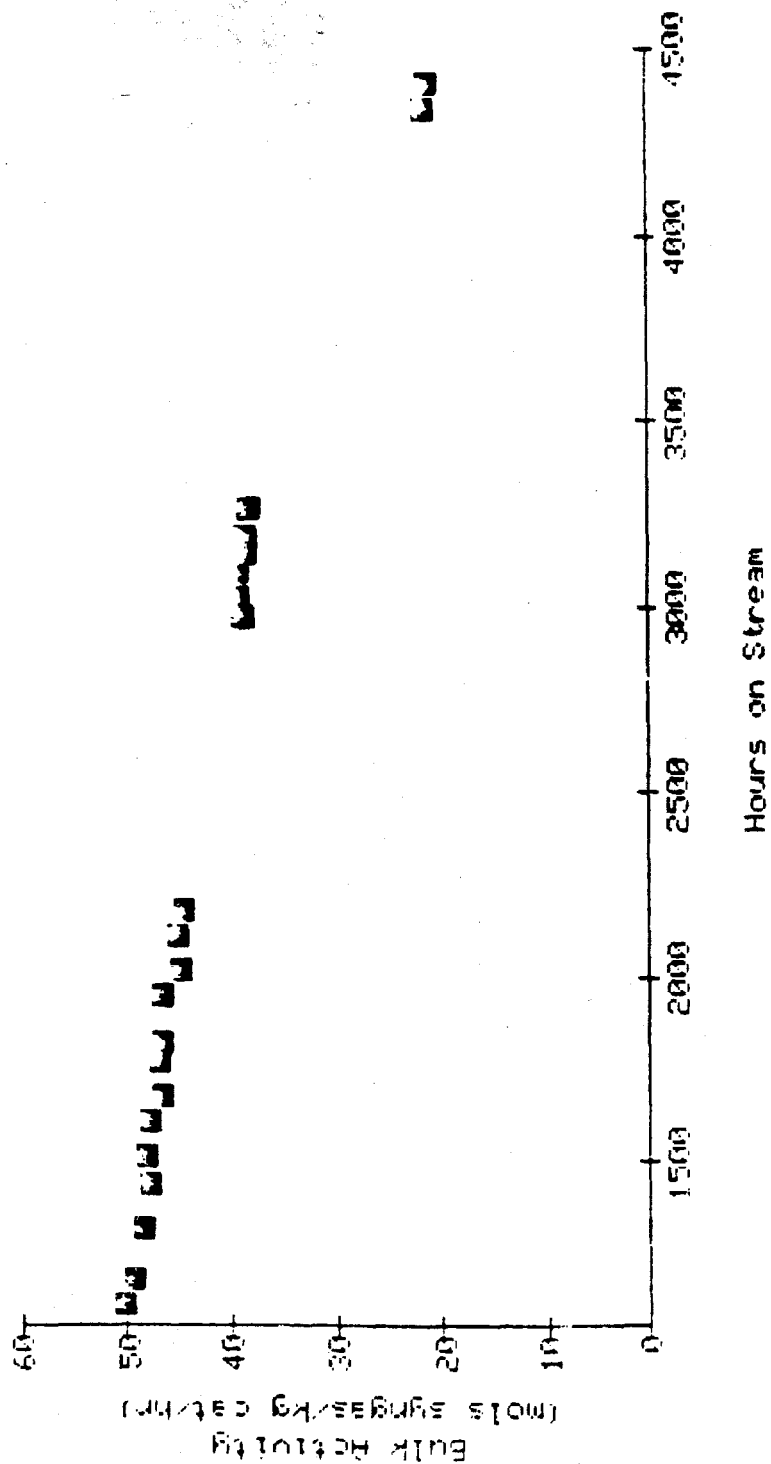


FIGURE 23

Conversion Maintenance--Extended Slurry Test 8862-1-31
 Catalyst 5102, 260°C, CO/H₂ = 1.0, 2.0 NL/g/hr, 200 psig

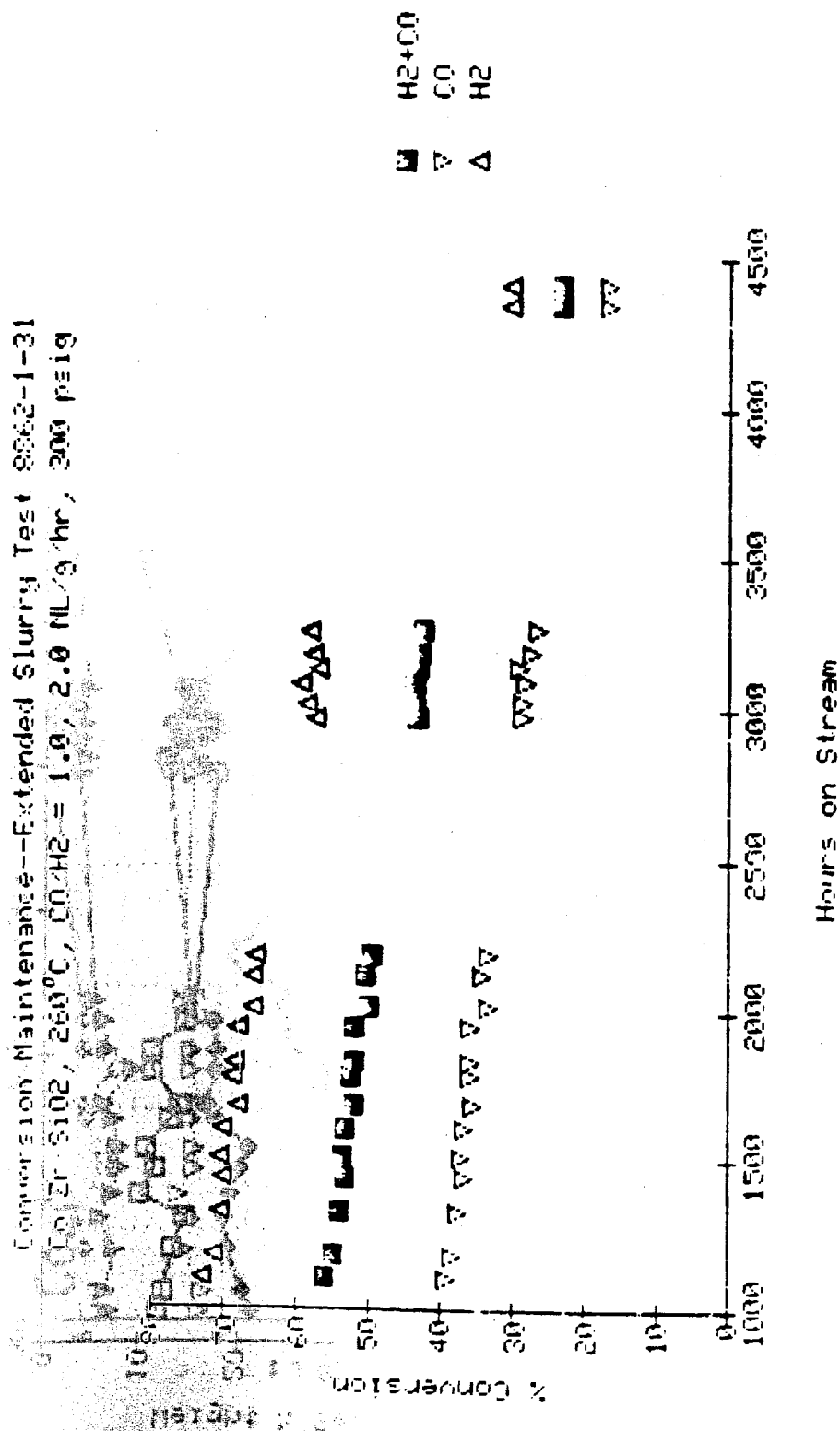


FIGURE 24

Hydrocarbon Selectivity--Extended Slurry Test 8262-1-31
 Co/Zr/SiO₂, 260°C, CO/H₂ = 1.0, 2.0 NL/g/hr, 300 psig

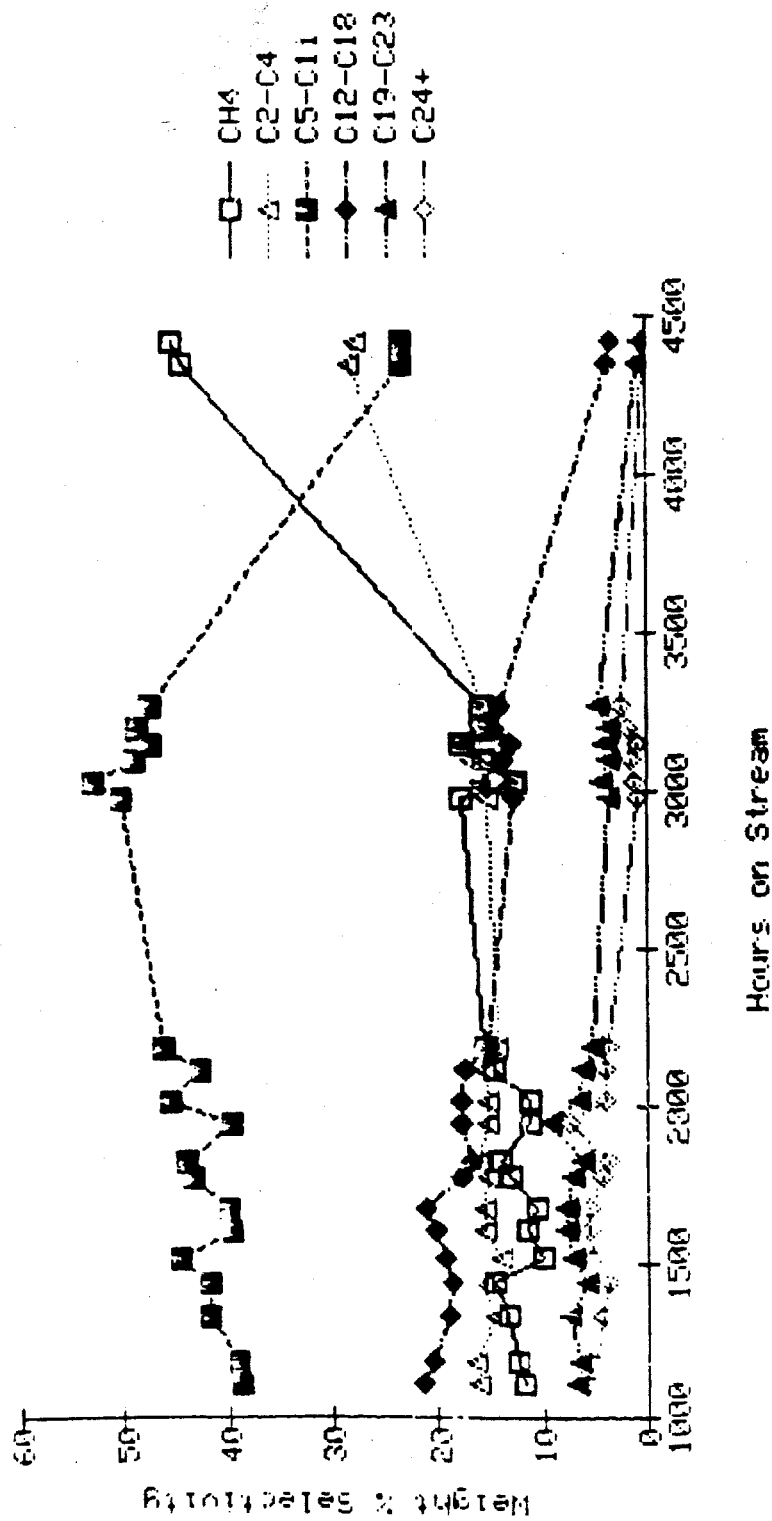


FIGURE 25

X-RAY PHOTOELECTRON SPECTRA OF:

8466-2: OXIDIZED $\text{Co}(\text{NO}_3)_2/\text{Zr}/\text{Al}_2\text{O}_3$; - 4: FRESH $\text{Co}_2(\text{CO})_8/\text{Zr}/\text{Al}_2\text{O}_3$; - 4a: REDUCED $\text{Co}_2(\text{CO})_8/\text{Zr}/\text{Al}_2\text{O}_3$

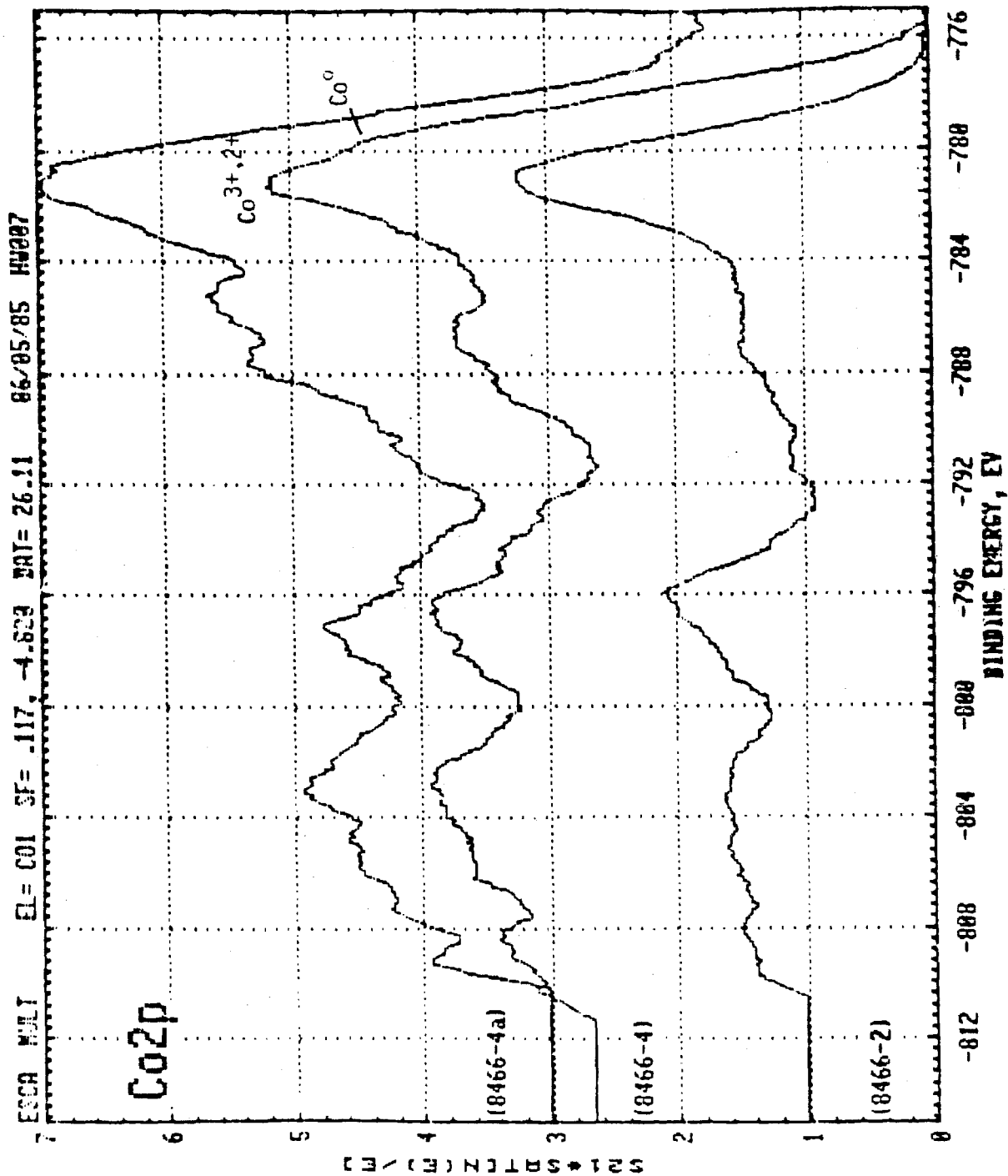


FIGURE 26

X-RAY PHOTOELECTRON SPECTRUM OF: FRESH $\text{Co}_2(\text{CO})_8/\text{Zr/SiO}_2$ (CATALYST # 8466-18)

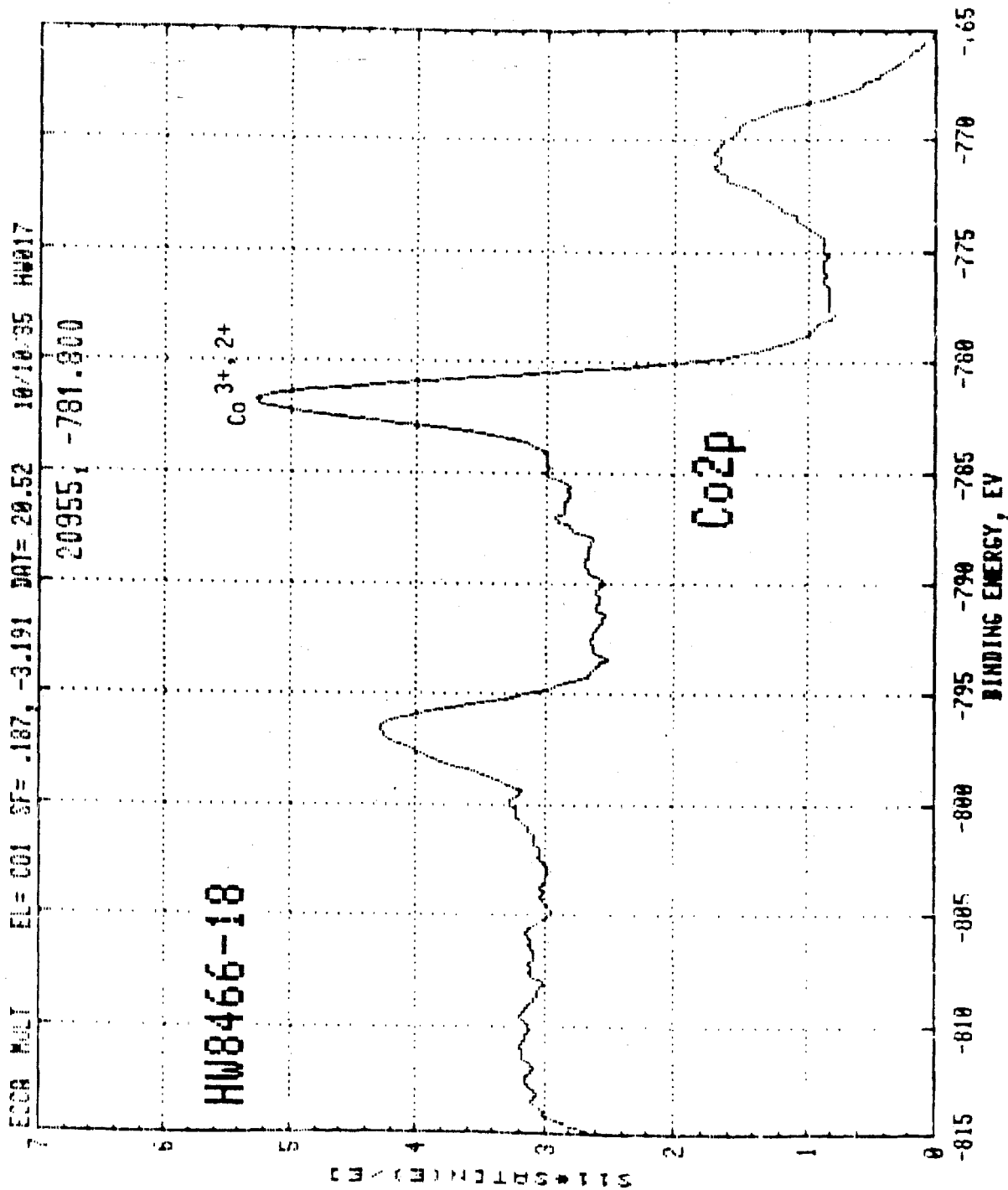


FIGURE 26A

X-RAY PHOTOELECTRON SPECTRUM OF: REDUCED Co/7r/SiO₂ (CATALYST #8466-18)

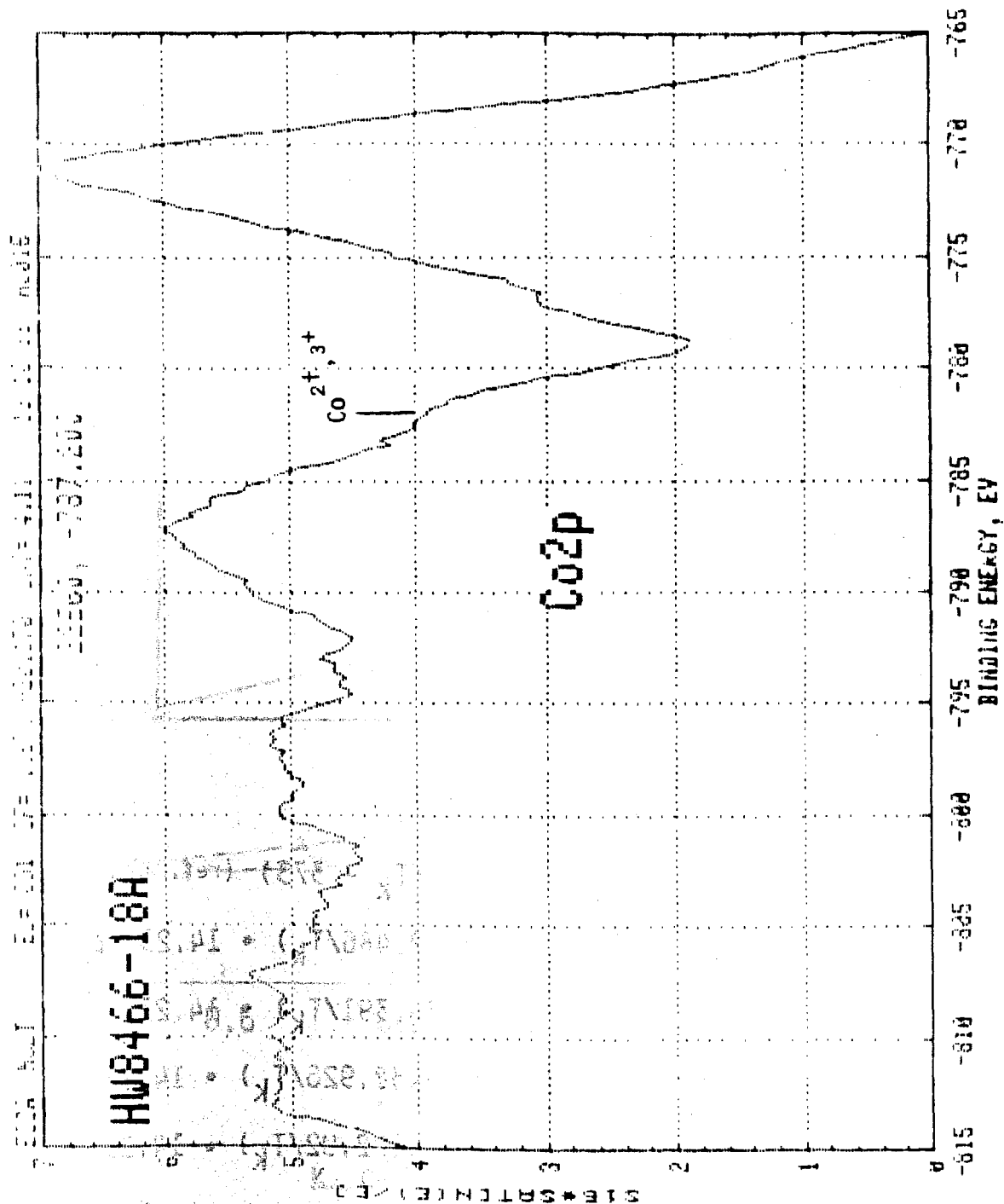
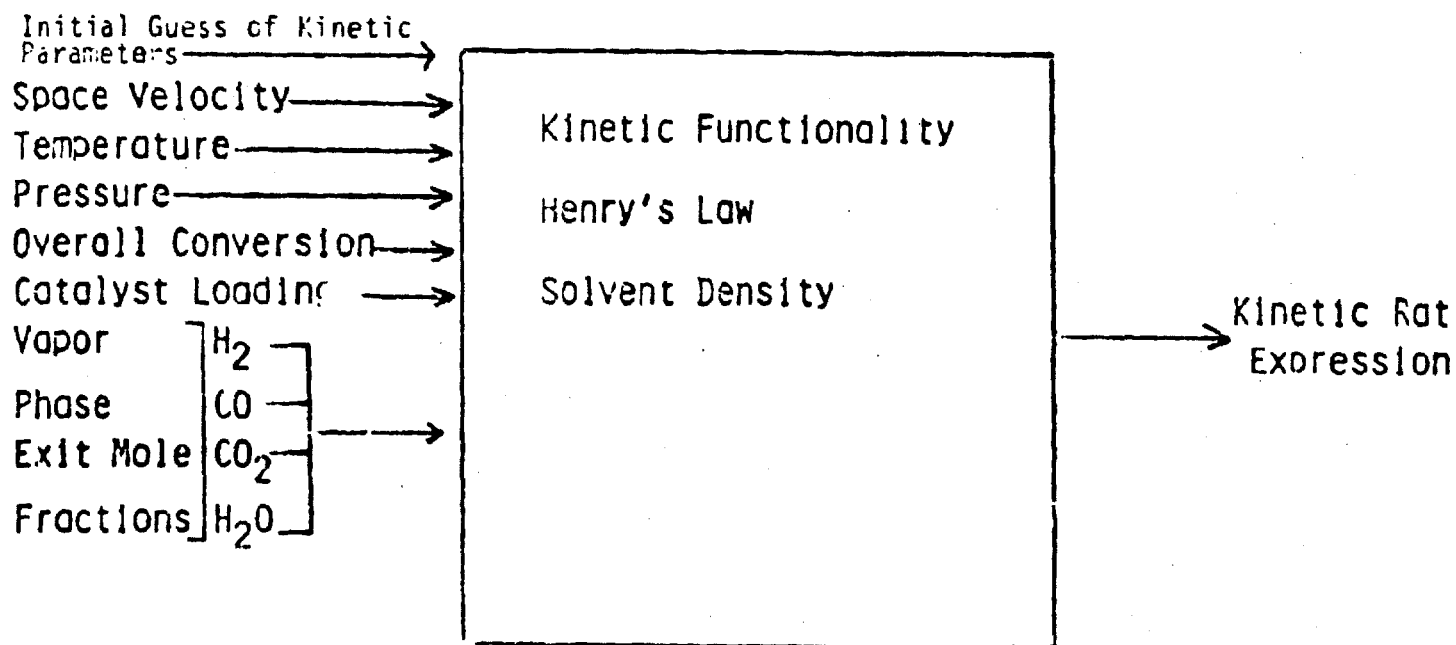


FIGURE 27
KINETIC DATA ANALYSIS PROGRAM



$$\rho = 0.758 - 0.555 \cdot (T_K - 373) \text{ (ref. 1)}$$

$$He_{H_2} = 34.162 \cdot \exp(739.486/T_K) \cdot 14.23 \text{ psia/mol/kg oil (ref. 2)}$$

$$He_{CO} = 44.583 \cdot \exp(433.391/T_K) \cdot 14.23$$

$$He_{CO_2} = 119.925 \cdot \exp(-438.926/T_K) \cdot 14.23$$

$$He_{H_2O} = 275.113 \cdot \exp(-1122.92/T_K) \cdot 14.23$$

¹Deckwer et.al., I&EC PDD, 1980, 19, 699.

²Peter and Weinert, Z.F.P. Chemie, 5, 1955, 114.

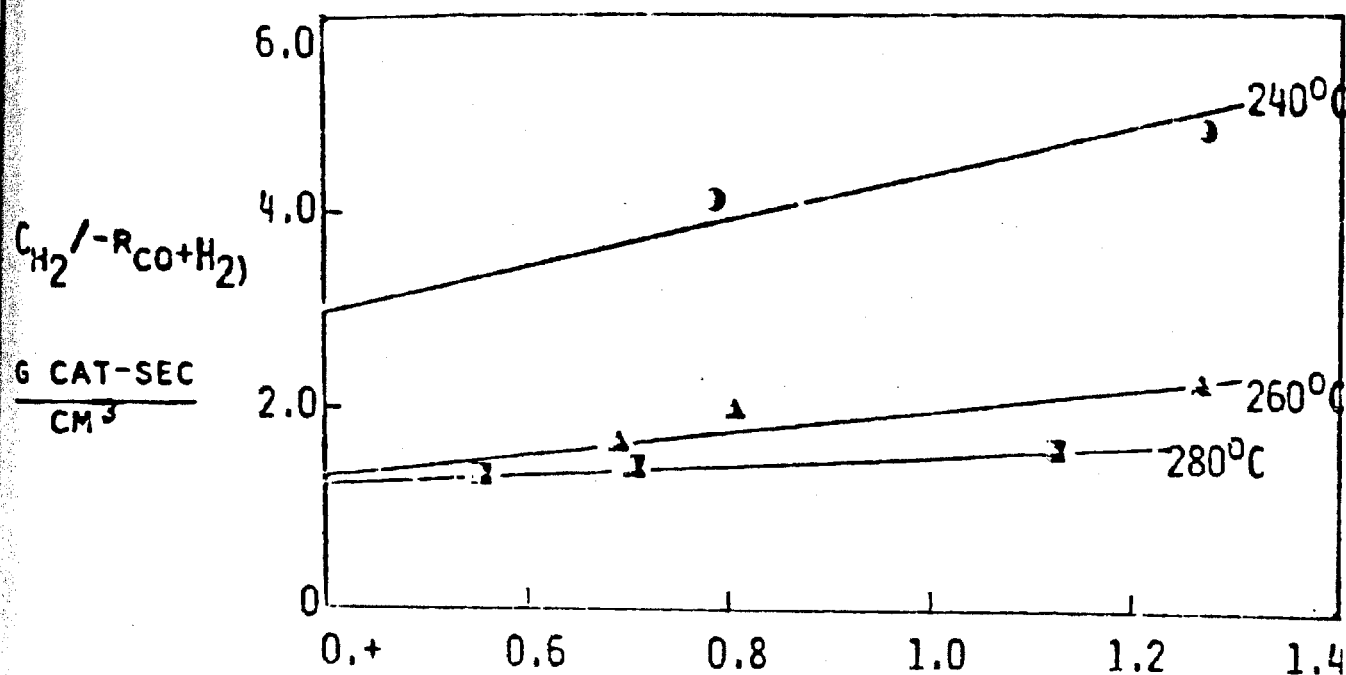
FIGURE 28

FITTING $\text{CO}_2(\text{CO})_8/\text{Zr}(\text{OP}_R)_4/\text{SiO}_2$ DATA

BY

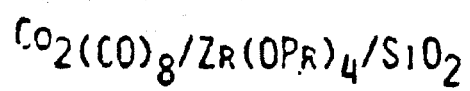
$$-R_{\text{CO}+\text{H}_2} = \frac{k C_{\text{H}_2} C_{\text{CO}}}{C_{\text{CO}} + K C_{\text{H}_2\text{O}}}$$

$$\text{LINEARIZED} = \frac{C_{\text{H}_2}}{-R_{\text{CO}+\text{H}_2}} = \frac{1}{K} + \frac{K}{K} \frac{C_{\text{H}_2\text{O}}}{C_{\text{CO}}}$$



	$\frac{C_{\text{H}_2\text{O}}}{C_{\text{CO}}}$	
	$K, \text{CM}^3/\text{G CAT. SEC.}$	K
240	0.328	0.466
260	0.709	0.439
280	0.775	0.302

FIGURE 29



ACTIVATION ENERGY

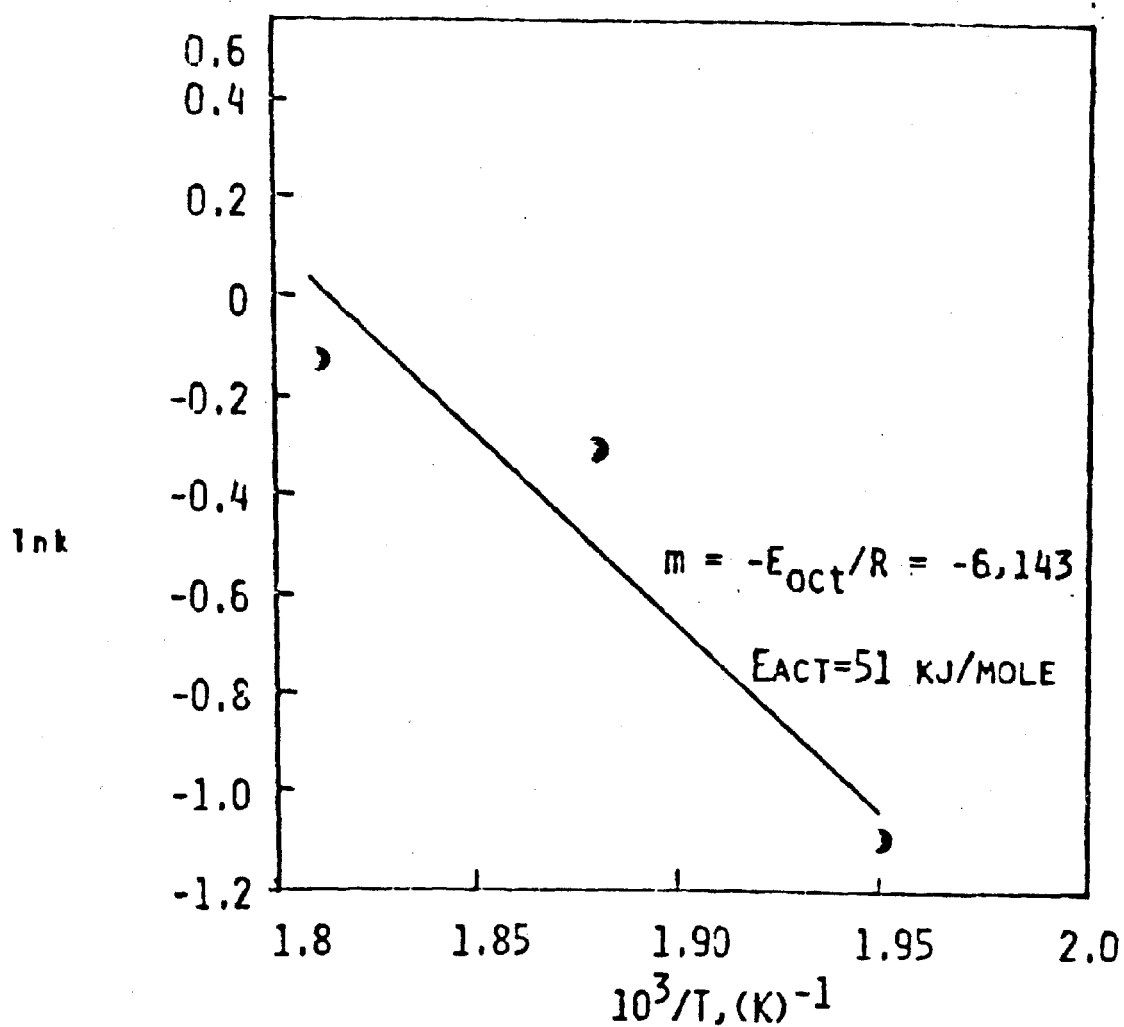


FIGURE 30

Linear Fit for Kinetic Model 4

Temperature = 260°C

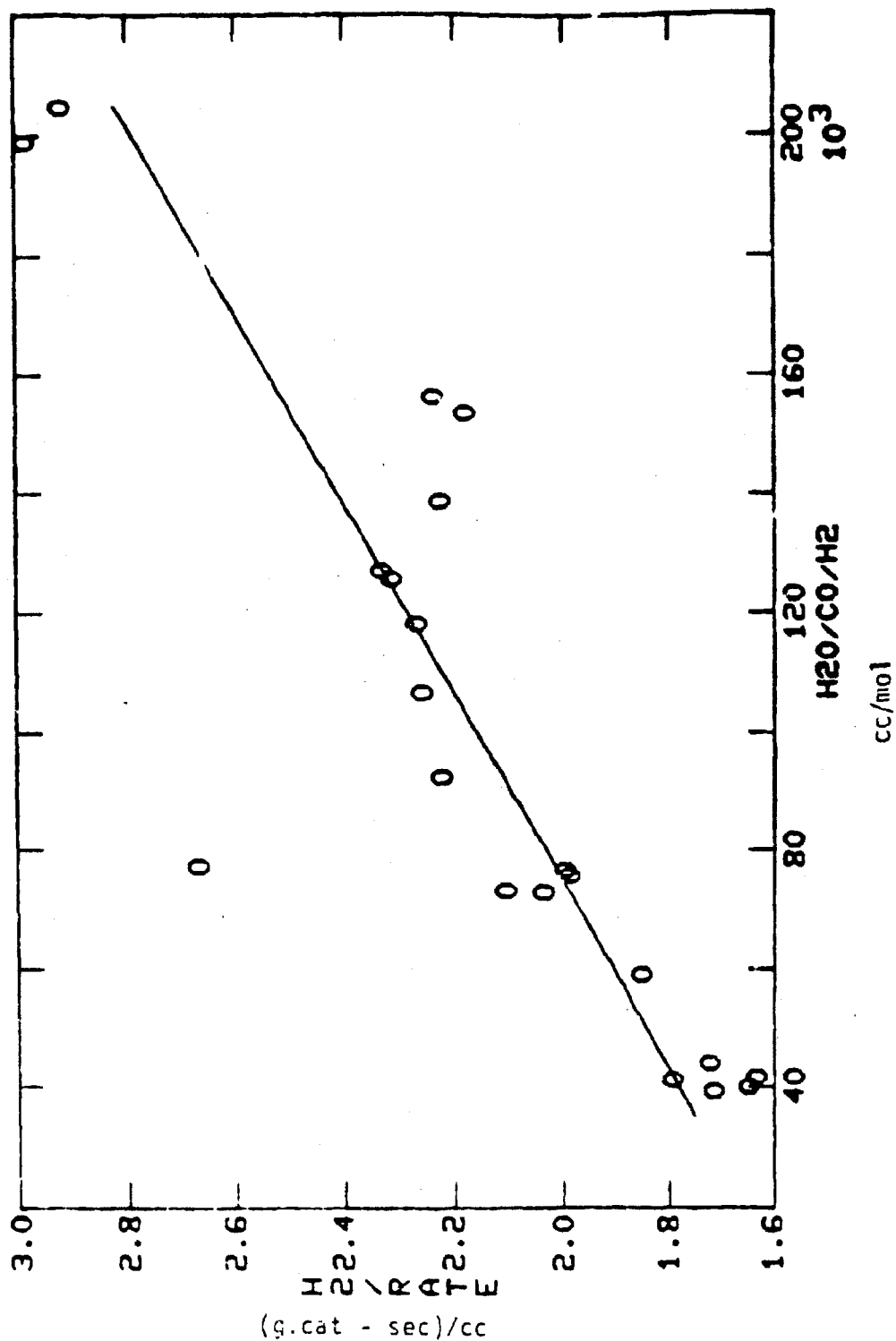


FIGURE 31

Parity Plot for Kinetic Model 4

Temperature = 260°C

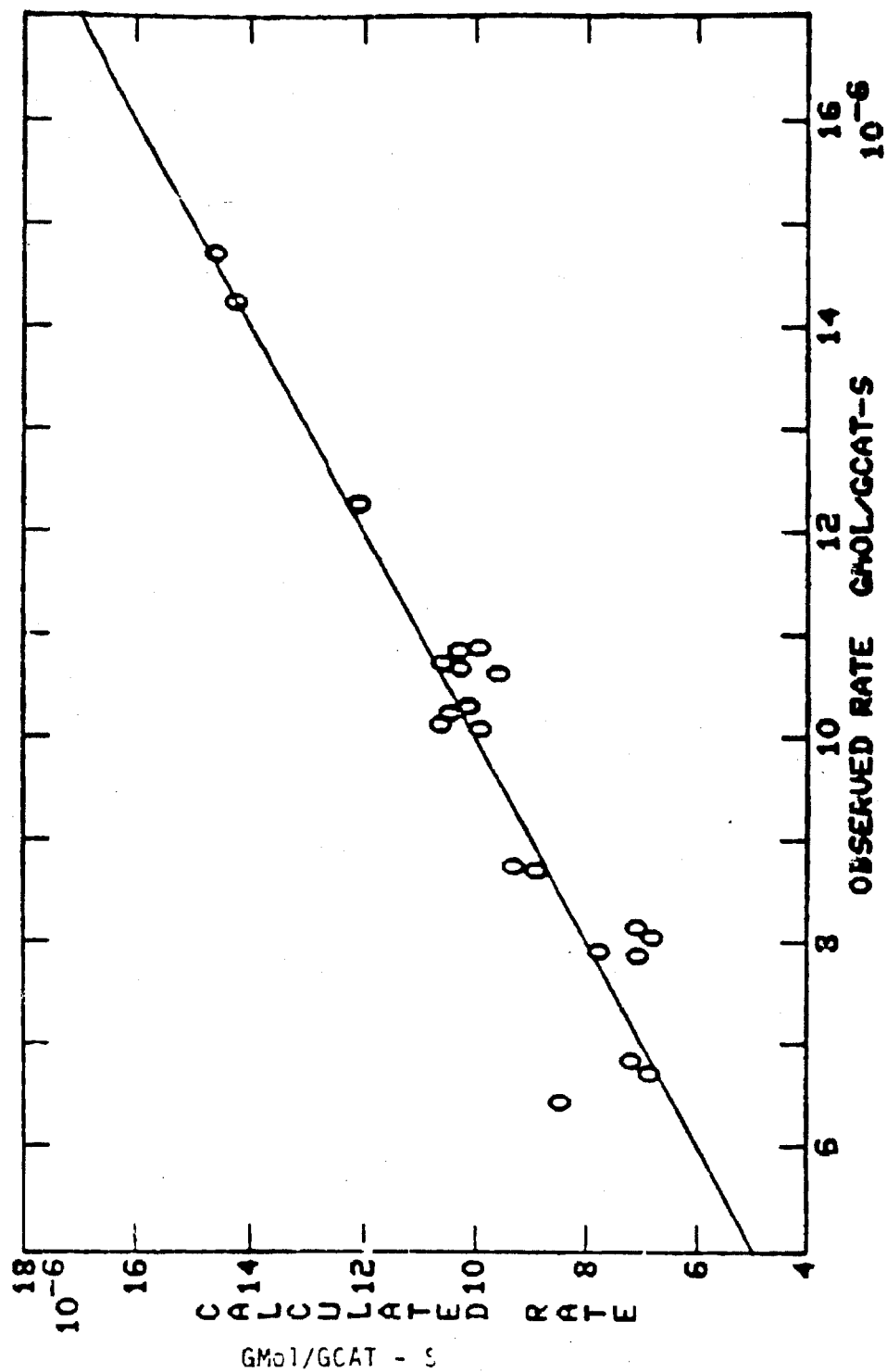


FIGURE 32
 CATALYST DEACTIVATION: EXTENDED SLURRY TEST
 #8862-1-31, 240° - 260 C

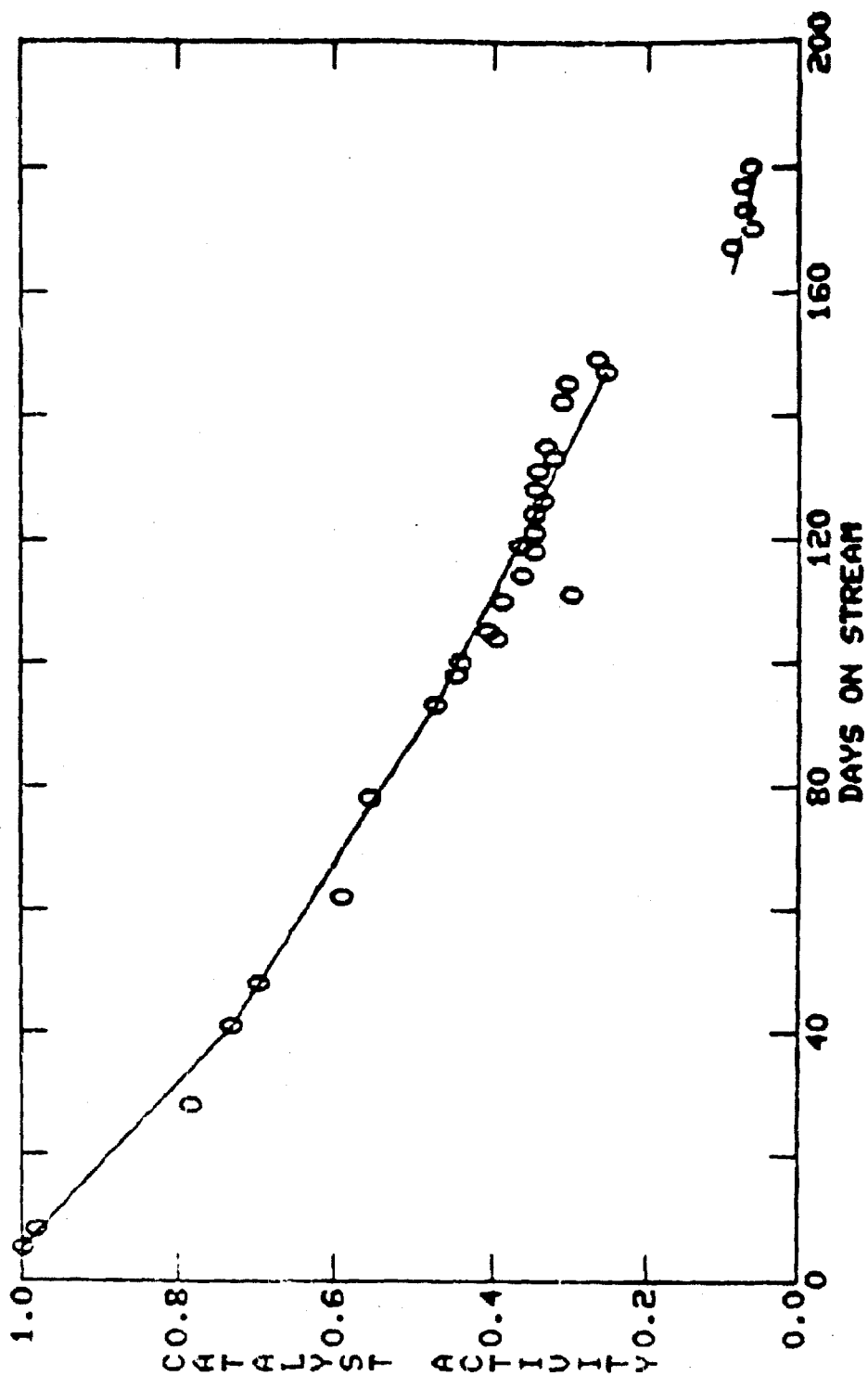


FIGURE 33

Arrhenius Plot = Extended Slurry Test

#8862-1-31

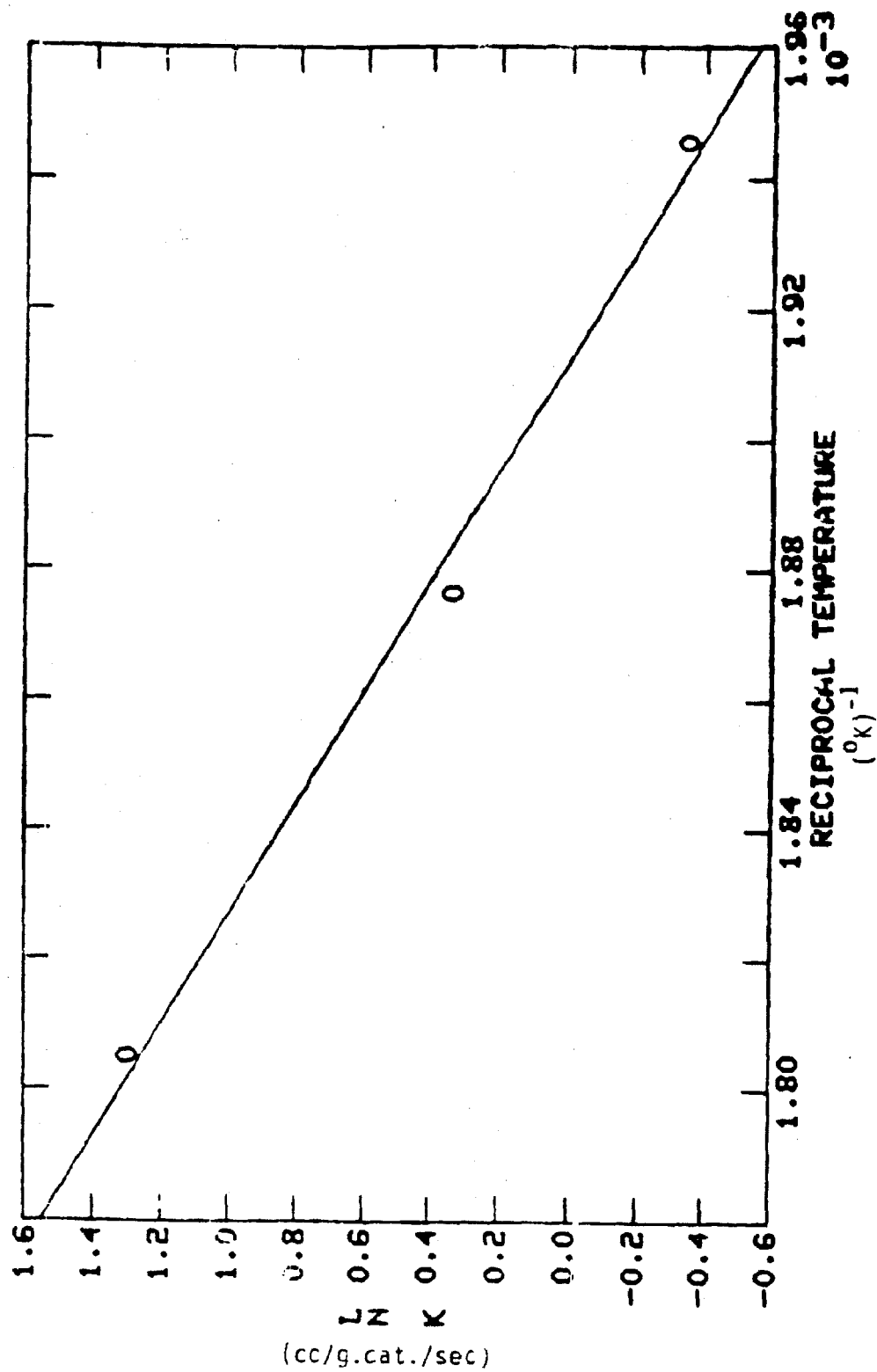


FIGURE 34

GAS PHASE SCREENING SYSTEM

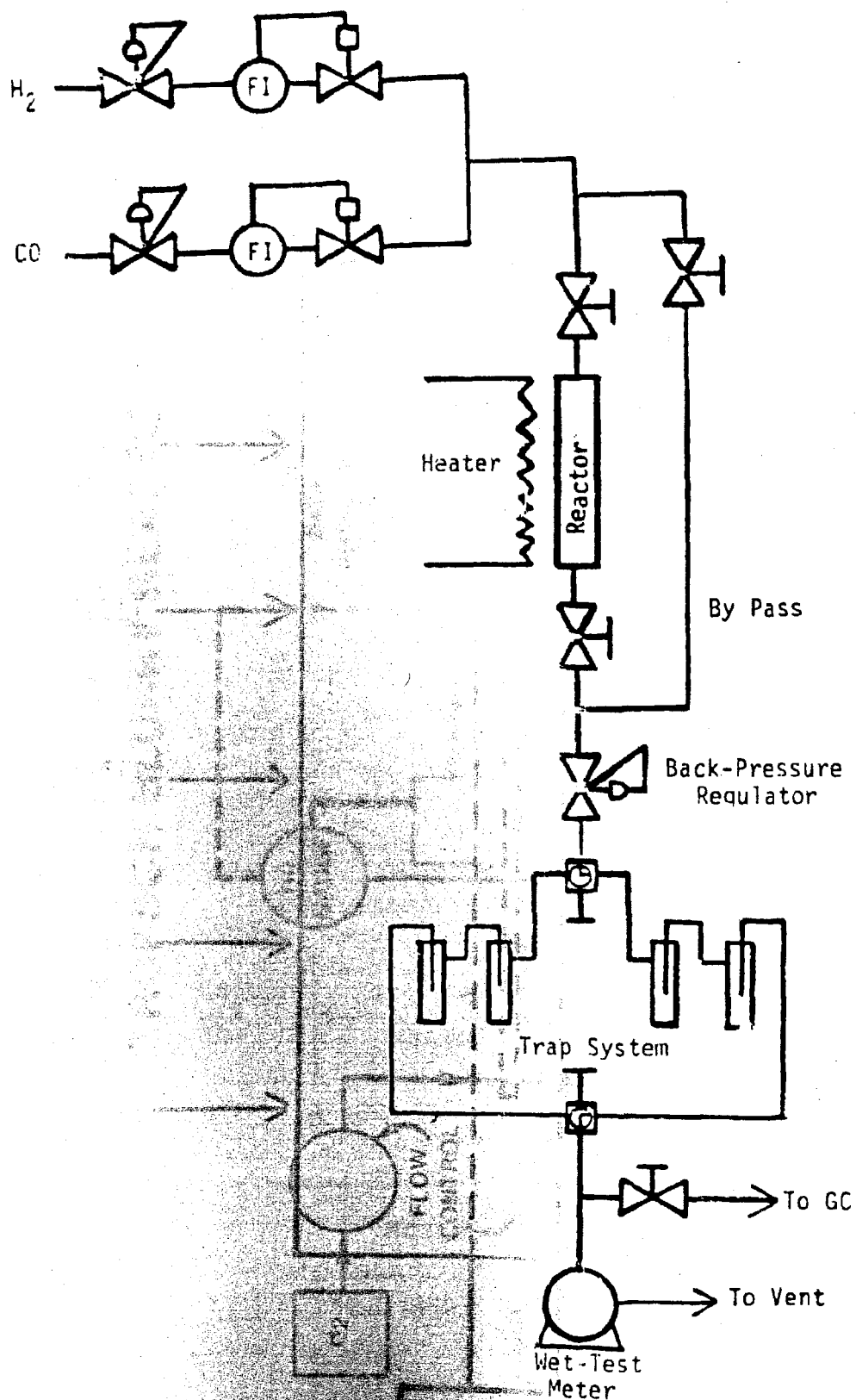


FIGURE 35

Reactor Temperature Measurement

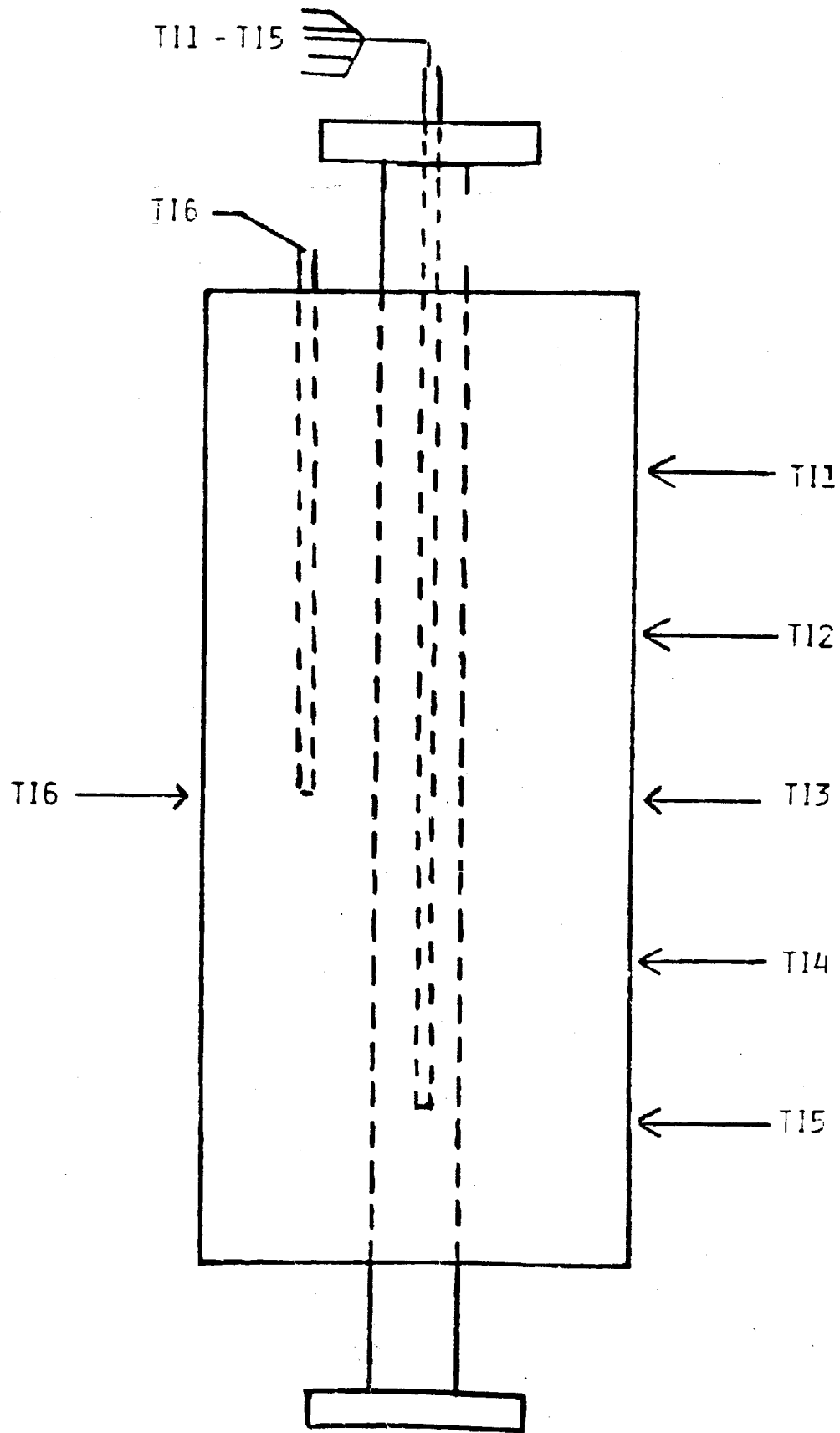


FIGURE 36

CONTINUOUS, AUTOMATED FISCHER-TROPSCH SLURRY REACTOR

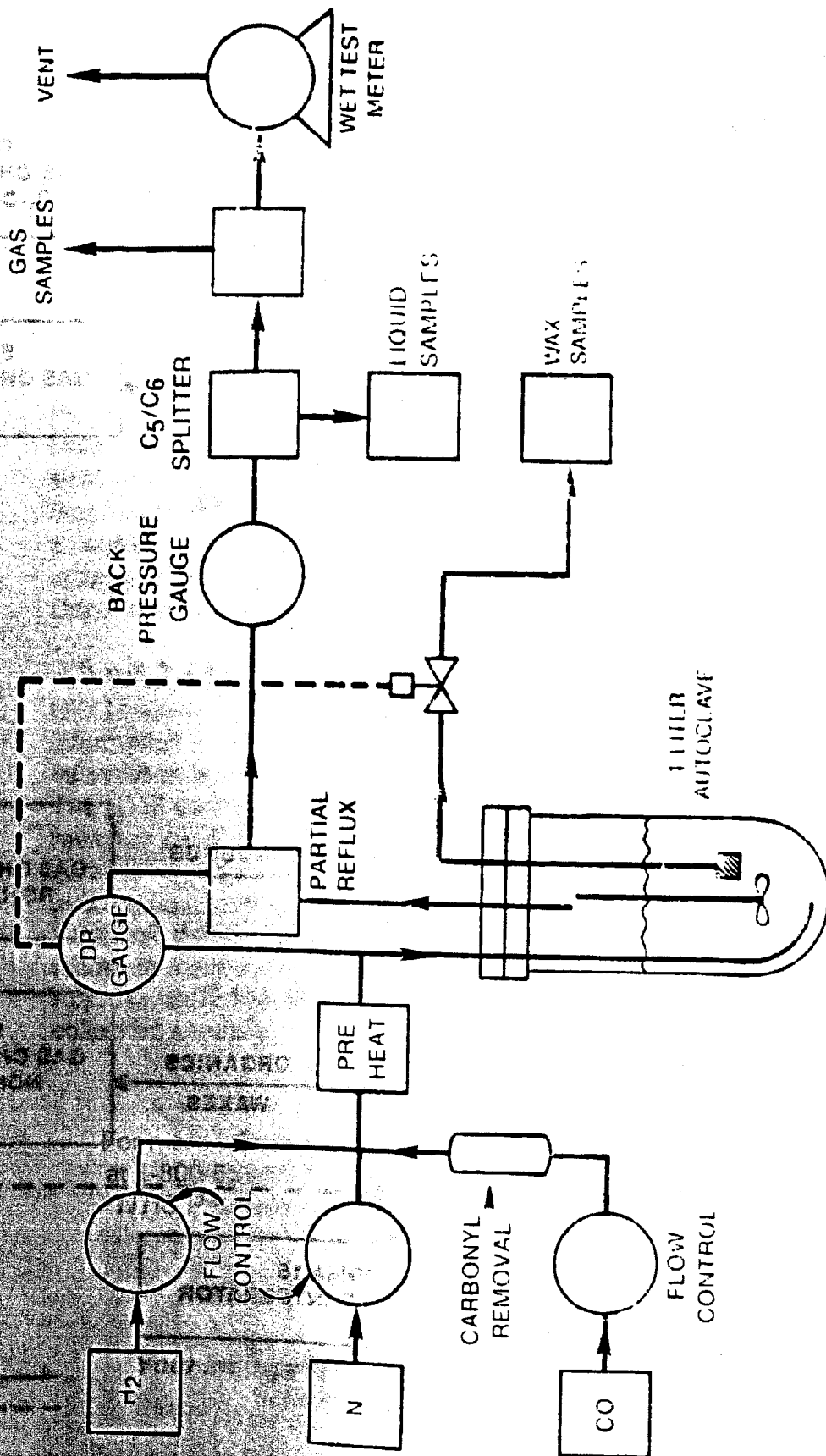


FIGURE 37
PRODUCT ANALYTICAL SCHEME

