

BENZENE FORMATION.

Table 38 following shows the percentages of benzene formed under varying conditions of temperature and pressure. It appears from the table that benzene is formed in appreciable quantity from each of the three hydrocarbons, cymene, xylene, and toluene. The figures in Tables 30 to 35 indicate that neither benzene nor any of the other three monocyclic compounds is produced by the cracking of naphthalene or anthracene.

Table 38 shows that optimum conditions for benzene formation are represented by the temperatures 650° and 725° C., and that pressure is favorable up to a certain limit which appears to be somewhere between 1 and 12 atmospheres. The runs at 18 atmospheres in general showed decreases in the amount of benzene produced. This seems to indicate that at some pressure between 1 and 12 atmospheres a sufficient concentration was attained to permit the hydrocarbons to reach a state of equilibrium during their passage through the furnace and that the higher pressures were unfavorable for benzene production, as is indicated by the volume changes occurring in the reactions.

TABLE 38.—Results of cracking four aromatic hydrocarbons under various conditions of temperature and pressure, showing percentages of benzene formed.

Hydrocarbon cracked.	Temperature.	Percentage of benzene formed at pressure of—				Average percentage recovered.
		Vacuum.	1 atmosphere.	12 atmospheres.	18 atmospheres.	
	° C.					
Cymene.....	650	0.2	9.2	12.0	15.1	5.1
Do.....	725	.2	3.7	10.2	3.8	
Do.....	800	1.5	1.6	3.8	.0	
Xylene.....	650	.3	4.1	3.8	.6	3.1
Do.....	725	.0	2.0	3.2	.0	
Do.....	800	.7	8.3	9.1	5.4	
Toluene.....	650	.0	3.9	21.8	18.3	12.3
Do.....	725	2.1	17.3	30.7	10.4	
Do.....	800	5.6	17.6	16.4	3.0	
Benzene.....	650	78.5	66.5	59.4	57.0	50.7
Do.....	725	77.5	61.5	39.7	42.3	
Do.....	800	63.0	35.6	16.1	12.1	

TOLUENE FORMATION.

The figures on toluene formation are shown in Table 39 following. Toluene may be formed from both xylene and cymene, being more readily formed from the former. The amount that can be produced from benzene is negligible, and none can be produced from naphthalene and anthracene. The effects of temperature and pressure seem rather irregular, possibly on account of experimental error. The general tendency seems to have been for maximum yields to occur with decreasing temperature as pressure increases. Thus, in the xylene figures a maximum appears at 800° C. for vacuum runs,

at 725° C. for runs at 1 atmosphere, and 650° C. for runs at 12 atmospheres. Beyond this point the curve seems to swing the other way. A like tendency will be noted among cymene figures if the obviously wrong bracketed value is omitted from consideration.

TABLE 39.—Results of cracking four aromatic hydrocarbons under various conditions of temperature and pressure, showing percentage of toluene formed.

Hydrocarbon cracked.	Temperature.	Percentage of toluene formed at pressure of—				Average percentage formed.
		Vacuum.	1 atmosphere.	12 atmospheres.	18 atmospheres.	
	° C.					
Cymene.....	650	[14.5]	2.5	2.7	1.9	4.0
Do.....	725	3.9	7.4	2.3	5.0	
Do.....	800	4.7	1.9	1.3	.0	
Xylene.....	650	2.6	15.4	18.7	9.2	11.4
Do.....	725	9.2	34.5	15.2	12.6	
Do.....	800	18.5	7.2	8.6	.8	
Toluene.....	650	91.6	85.0	55.0	31.0	37.1
Do.....	725	70.5	34.0	7.5	2.7	
Do.....	800	49.5	6.6	7.5	4.0	
Benzene.....	650	1.6	.0	.1	.5	.5
Do.....	725	1.4	.9	.0	.0	
Do.....	800	1.0	.5	.0	.0	

XYLENE FORMATION.

Table 40 shows the figures on xylene formation and indicates that although xylene may be formed in moderate quantity from cymene the amounts produced from toluene and benzene are exceedingly small. The formation of xylene seems to be favored by low temperatures and low pressure.

TABLE 40.—Results of cracking four aromatic hydrocarbons under various conditions of temperature and pressure, showing percentage of xylene formed.

Hydrocarbon cracked.	Temperature.	Percentage of xylene formed at pressure of—				Average percentage formed.
		Vacuum.	1 atmosphere.	12 atmospheres.	18 atmospheres.	
	° C.					
Cymene.....	650	17.8	5.9	4.0	4.9	5.4
Do.....	725	8.9	5.2	2.1	2.8	
Do.....	800	9.5	1.6	1.6	.0	
Xylene.....	650	80.0	37.7	31.7	45.0	30.6
Do.....	725	52.5	40.0	27.0	26.0	
Do.....	800	35.6	4.5	7.9	1.1	
Toluene.....	650	3.4	.0	.0	.0	.9
Do.....	725	4.2	.0	.7	.0	
Do.....	800	.0	.0	1.2	1.6	
Benzene.....	650	.8	.0	.0	.0	.4
Do.....	725	1.4	.7	.0	.0	
Do.....	800	1.7	.5	.0	.0	

CYMENE FORMATION.

Cymene is formed in negligible quantity from xylene, toluene, and benzene, and not at all from naphthalene and anthracene, as is shown by the results presented in Table 41, following. This compound appears to be particularly unstable under the conditions of the