

Равновесие тяжелой рамы

Тяжелая однородная рама расположена в вертикальной плоскости и опирается на неподвижный шарнир A и наклонный невесомый стержень H . К раме приложены горизонтальная сила P , наклонная сила Q и момент M . Учитывая погонный вес рамы ρ , найти реакции опор.

Кирсанов М.Н. Решебник. Теоретическая механика с. 31.

Вариант 1
С4.

$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 24 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 2
С4.

$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 16 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 3
С4.

$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 21 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 4
С4.

$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 21 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 5
С4.

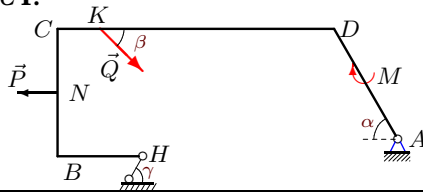
$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 19 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 5 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 6
С4.

$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 14 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 8 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 7

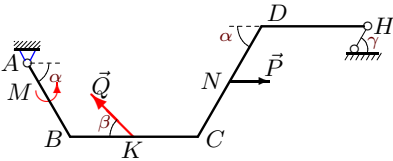
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 34 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 13 \text{ м}$, $DA = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 8

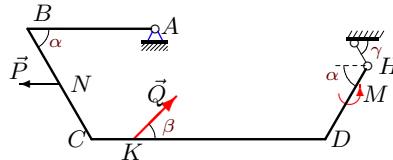
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 17 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 9

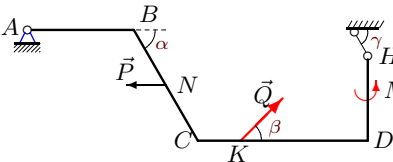
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 20 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 10

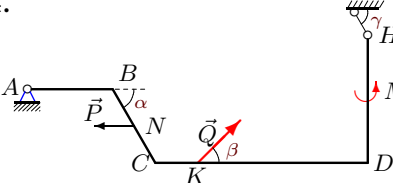
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 11 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 8 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 11

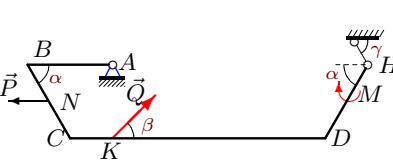
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 12 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 10 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 12

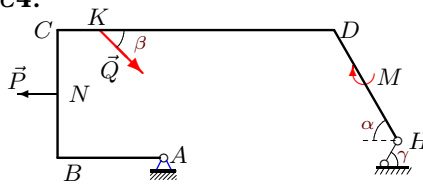
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 25 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 12 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 13

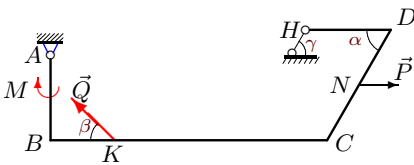
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 30 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 13 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 14

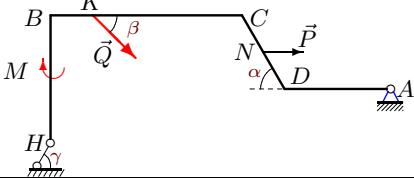
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 30 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 13 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 4 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 15

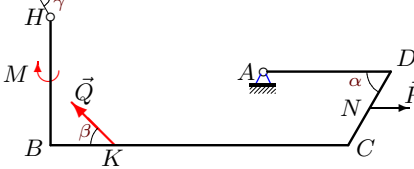
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 32 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 9 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 16

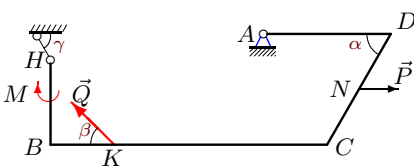
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 35 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 17

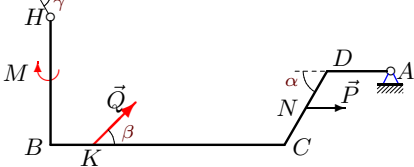
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 30 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 13 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 18

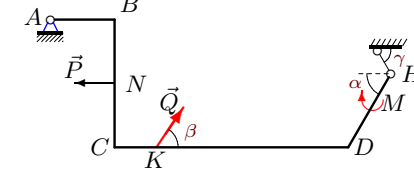
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 11 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 3 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 19

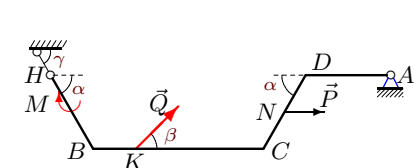
C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 27 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 3 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 20

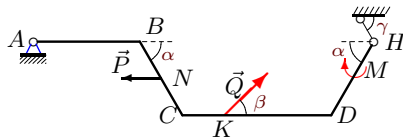
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 22 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 4 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 21

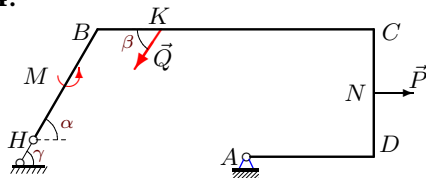
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 23 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 7 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 22

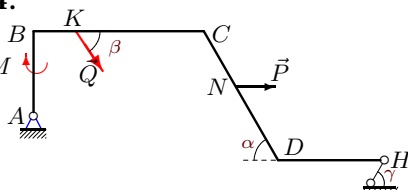
C4.



$\rho = 3 \text{ кН/м}$, $P = 9 \text{ кН}$,
 $Q = 13 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 13 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 23

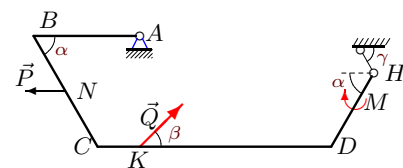
C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 7 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 24

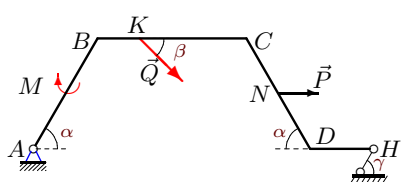
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 25 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 25

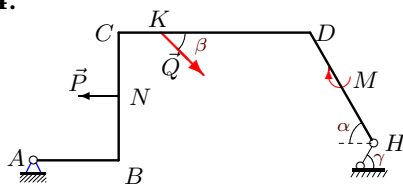
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 23 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 3 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 26

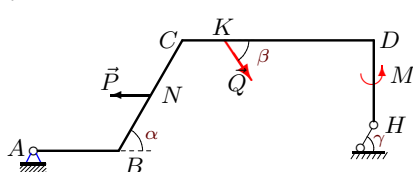
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 29 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 9 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 27

C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 15 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 9 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 28

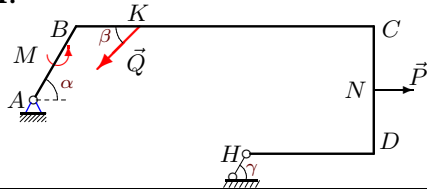
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 29 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 4 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 29

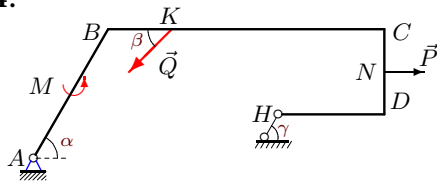
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 11 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 30

C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 15 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 7 \text{ м}$, $BC = 13 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Ответы

	$M_A(Q)$	$M_A(P)$	$\Sigma_k M_A(G_k)$	h	X_A	Y_A	R_H
1	110.918	-12.124	-367.0	12.538	40.224	8.776	22.986
2	73.945	-10.392	-183.5	9.500	25.513	4.952	9.468
3	-10.500	4.330	-158.5	6.500	-4.756	0.141	20.718
4	-21.000	12.990	-177.5	6.500	2.467	19.538	23.925
5	28.500	-12.990	-161.0	8.000	-1.048	24.282	14.436
6	157.617	-20.785	-423.0	10.468	16.953	17.922	22.561
7	211.659	17.569	853.5	-9.990	-68.979	19.351	105.875
8	18.463	5.196	-158.5	6.500	-7.948	0.914	16.129
9	80.000	-15.588	-37.0	5.846	-20.683	53.363	-13.241
10	104.500	-15.588	-423.0	10.468	15.664	21.310	27.139
11	97.276	-10.392	-234.0	10.196	7.462	9.772	11.486
12	75.000	-10.392	-144.0	8.485	-7.368	27.217	11.713
13	-63.640	21.000	-68.0	7.210	-27.026	68.401	18.120
14	-21.213	9.813	-455.0	7.639	-30.808	-12.234	63.669
15	238.400	-13.856	708.0	-12.588	-66.674	32.193	72.093
16	-227.500	12.124	192.0	-7.392	20.039	78.167	-6.544
17	-258.719	20.785	121.5	-9.258	5.575	79.017	-15.276
18	-124.000	12.124	696.0	-12.588	-11.639	18.035	44.416
19	197.913	-21.000	-176.0	5.804	-4.398	-0.596	2.427
20	-66.000	12.124	504.0	-13.856	-10.712	22.430	30.681
21	202.709	-10.392	-170.0	8.000	-11.056	4.194	-0.915
22	84.033	-27.000	10.5	-9.062	-10.088	91.115	15.177
23	-115.694	-9.813	-170.2	10.036	-49.316	35.365	30.965
24	91.856	-18.187	-90.0	6.553	-6.758	30.402	5.544
25	-161.000	-15.588	-334.0	11.314	-59.080	22.338	46.898
26	-237.688	15.000	-195.5	7.304	-71.478	9.845	59.310
27	-155.885	18.187	-208.5	6.964	-39.821	13.288	45.404
28	-56.959	11.340	-214.0	6.464	-16.677	-9.742	42.484
29	5.500	-2.785	-608.0	8.864	-40.769	21.204	62.643
30	30.000	-24.373	-556.5	6.674	-46.080	12.429	75.053