

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.

$\rho = 3 \text{ кН/м}, P = 9 \text{ кН},$
 $Q = 14 \text{ кН}, M = 70 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 60^\circ, \gamma = 60^\circ,$
 $HB = 6 \text{ м}, BC = 13 \text{ м},$
 $CD = 4 \text{ м}, DA = 4 \text{ м},$
 $BK = 3 \text{ м}, CN = 2 \text{ м}.$

Вариант 2
С4.

$\rho = 1 \text{ кН/м}, P = 6 \text{ кН},$
 $Q = 17 \text{ кН}, M = 30 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 45^\circ, \gamma = 30^\circ,$
 $AB = 4 \text{ м}, BC = 4 \text{ м},$
 $CD = 12 \text{ м}, DH = 4 \text{ м},$
 $CK = 2 \text{ м}, CN = 2 \text{ м}.$

Вариант 3
С4.

$\rho = 3 \text{ кН/м}, P = 9 \text{ кН},$
 $Q = 24 \text{ кН}, M = 25 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 60^\circ, \gamma = 60^\circ,$
 $HB = 4 \text{ м}, BC = 7 \text{ м},$
 $CD = 7 \text{ м}, DA = 4 \text{ м},$
 $BK = 2 \text{ м}, CN = 3 \text{ м}.$

Вариант 4
С4.

$\rho = 2 \text{ кН/м}, P = 6 \text{ кН},$
 $Q = 19 \text{ кН}, M = 50 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 45^\circ,$
 $AB = 5 \text{ м}, BC = 4 \text{ м},$
 $CD = 7 \text{ м}, DH = 4 \text{ м},$
 $CK = 2 \text{ м}, CN = 2 \text{ м}.$

Вариант 5
С4.

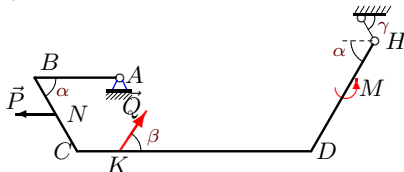
$\rho = 3 \text{ кН/м}, P = 7 \text{ кН},$
 $Q = 12 \text{ кН}, M = 70 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 60^\circ,$
 $HB = 4 \text{ м}, BC = 11 \text{ м},$
 $CD = 6 \text{ м}, DA = 3 \text{ м},$
 $BK = 2 \text{ м}, CN = 3 \text{ м}.$

Вариант 6
С4.

$\rho = 2 \text{ кН/м}, P = 7 \text{ кН},$
 $Q = 14 \text{ кН}, M = 50 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 45^\circ, \gamma = 45^\circ,$
 $AB = 7 \text{ м}, BC = 10 \text{ м},$
 $CD = 4 \text{ м}, DH = 3 \text{ м},$
 $BK = 2 \text{ м}, CN = 2 \text{ м}.$

Вариант 7

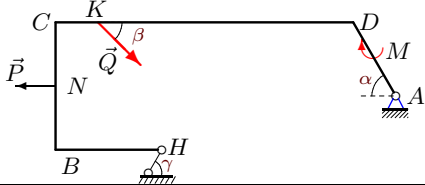
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 19 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 8

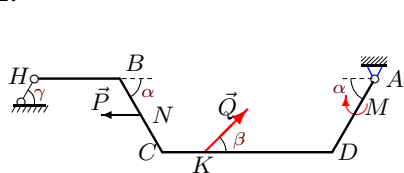
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 35 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 14 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 9

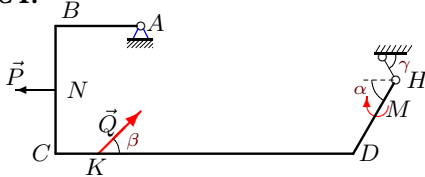
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 24 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 8 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 10

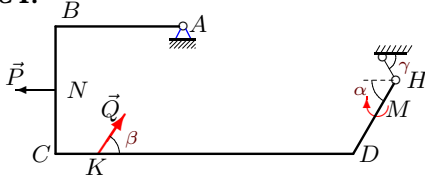
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 14 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 11

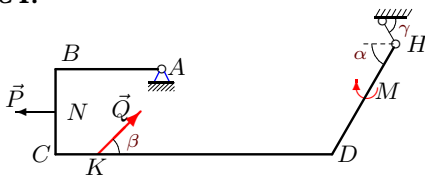
C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 33 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 14 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 12

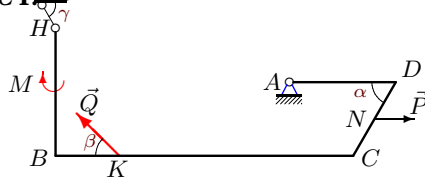
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 35 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 13 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 13

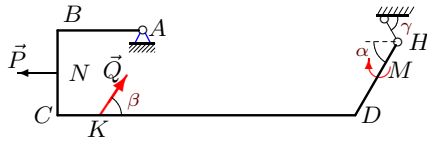
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 33 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 14

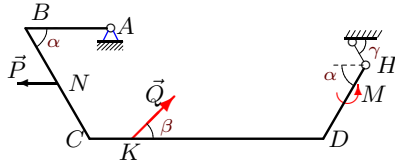
C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 14 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 15

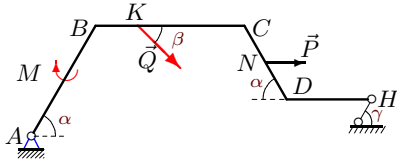
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 21 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 16

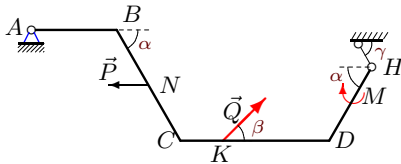
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 26 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 4 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 17

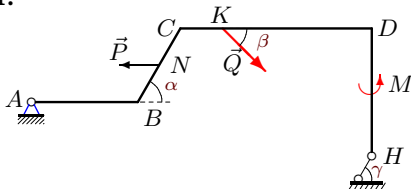
C4.



$\rho = 2 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 22 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 7 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 18

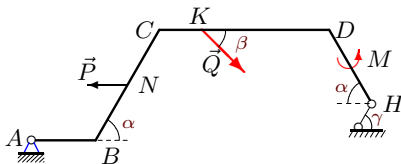
C4.



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

Вариант 19

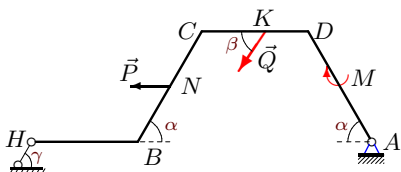
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 20 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 3 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 8 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 20

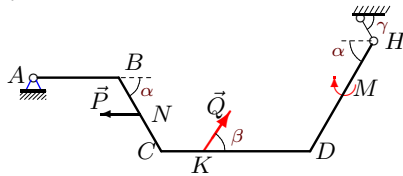
C4.



$\rho = 3 \text{ кН/м}$, $P = 9 \text{ кН}$,
 $Q = 22 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 60^\circ$,
 $HB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 5 \text{ м}$, $DA = 6 \text{ м}$,
 $CK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 21

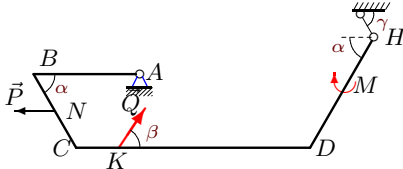
C4.



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

Вариант 22

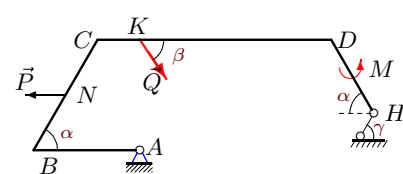
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 24 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 23

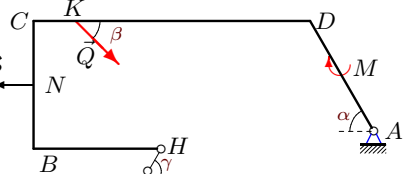
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 18 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 24

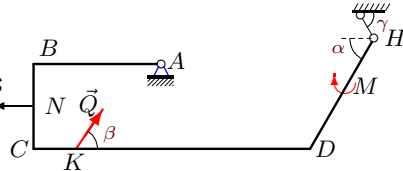
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 28 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 13 \text{ м}$, $DA = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 25

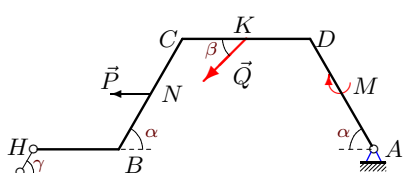
C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 27 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 13 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 26

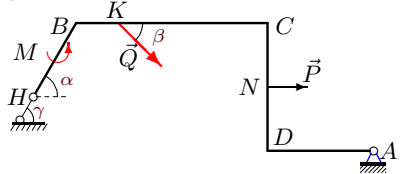
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 24 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 6 \text{ м}$,
 $CK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 27

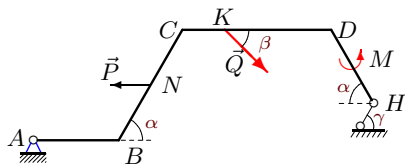
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 12 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 9 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 28

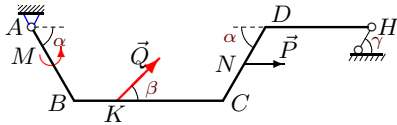
С4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 20 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 7 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 29

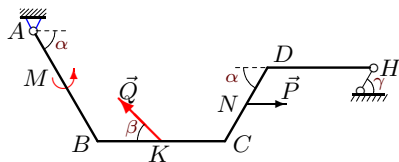
С4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 20 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 7 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 30

С4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 19 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Ответы

	$M_A(Q)$	$M_A(P)$	$\Sigma_k M_A(G_k)$	h	X_A	Y_A	R_H
1	100.746	-18.000	214.5	-9.794	-20.748	60.652	37.496
2	41.641	-10.392	-72.0	6.000	-4.469	11.083	1.792
3	187.061	-31.177	561.8	-15.588	-43.216	48.305	44.433
4	142.500	-10.392	-340.0	11.314	-0.586	20.632	13.956
5	9.646	-21.000	528.0	-15.124	-36.786	44.408	38.788
6	-114.460	-28.435	-392.5	10.209	-50.519	24.280	47.545
7	32.909	-13.856	-163.0	9.710	5.341	26.704	9.675
8	260.750	3.713	880.5	-8.258	-84.557	-5.698	135.616
9	-24.000	-12.124	456.0	-13.856	-28.033	23.320	28.498
10	87.681	-21.000	-108.0	6.692	-8.441	27.601	9.163
11	-15.315	-21.000	4.0	2.804	5.114	-7.016	16.875
12	68.744	-12.000	-88.0	8.624	-20.108	34.297	5.943
13	-231.000	12.124	280.5	-8.258	23.796	66.659	4.435
14	8.306	-14.000	-62.0	5.536	4.436	-8.316	14.938
15	105.000	-12.990	-70.5	4.500	-23.100	20.223	-11.447
16	-182.000	-17.321	-154.5	6.500	-76.656	5.629	56.742
17	220.840	-18.187	-349.0	10.089	3.102	14.785	16.488
18	-112.500	8.660	-236.0	10.196	-34.307	16.306	30.388
19	-170.000	15.588	-343.0	10.089	-42.678	20.642	44.347
20	152.420	23.383	483.0	-13.856	-2.870	45.440	45.741
21	199.186	-12.124	-181.5	9.500	-3.640	0.585	0.994
22	20.785	-13.856	-112.0	9.003	5.823	21.392	13.892
23	-46.765	20.785	-90.0	6.553	-8.119	60.469	10.068
24	70.000	15.373	919.5	-8.258	-76.575	4.244	118.653
25	-39.531	-14.000	-15.5	6.036	5.557	-1.344	13.922
26	180.000	18.187	492.0	-13.856	3.782	36.426	48.006
27	9.646	-21.000	564.0	-15.124	-37.977	42.347	41.168
28	-180.000	15.588	-349.0	10.089	-43.800	19.521	45.933
29	100.000	8.660	-150.0	8.000	-23.548	9.291	1.417
30	10.800	20.785	-152.5	9.500	-0.853	2.780	9.570