

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.

$\rho = 2 \text{ кН/м}, P = 8 \text{ кН},$
 $Q = 30 \text{ кН}, M = 20 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 60^\circ, \gamma = 45^\circ,$
 $AB = 4 \text{ м}, BC = 14 \text{ м},$
 $CD = 4 \text{ м}, DH = 4 \text{ м},$
 $BK = 3 \text{ м}, CN = 2 \text{ м}.$

Вариант 2
С4.

$\rho = 3 \text{ кН/м}, P = 9 \text{ кН},$
 $Q = 22 \text{ кН}, M = 25 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 60^\circ, \gamma = 60^\circ,$
 $HB = 6 \text{ м}, BC = 6 \text{ м},$
 $CD = 10 \text{ м}, DA = 6 \text{ м},$
 $CK = 2 \text{ м}, CN = 3 \text{ м}.$

Вариант 3
С4.

$\rho = 1 \text{ кН/м}, P = 5 \text{ кН},$
 $Q = 20 \text{ кН}, M = 30 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 30^\circ,$
 $AB = 6 \text{ м}, BC = 8 \text{ м},$
 $CD = 4 \text{ м}, DH = 3 \text{ м},$
 $BK = 2 \text{ м}, CN = 2 \text{ м}.$

Вариант 4
С4.

$\rho = 3 \text{ кН/м}, P = 7 \text{ кН},$
 $Q = 20 \text{ кН}, M = 70 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 60^\circ,$
 $HB = 3 \text{ м}, BC = 4 \text{ м},$
 $CD = 8 \text{ м}, DA = 6 \text{ м},$
 $CK = 2 \text{ м}, CN = 2 \text{ м}.$

Вариант 5
С4.

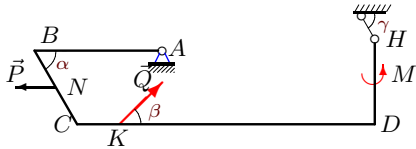
$\rho = 1 \text{ кН/м}, P = 5 \text{ кН},$
 $Q = 29 \text{ кН}, M = 15 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 30^\circ, \gamma = 30^\circ,$
 $AB = 5 \text{ м}, BC = 4 \text{ м},$
 $CD = 13 \text{ м}, DH = 6 \text{ м},$
 $CK = 2 \text{ м}, CN = 2 \text{ м}.$

Вариант 6
С4.

$\rho = 1 \text{ кН/м}, P = 7 \text{ кН},$
 $Q = 17 \text{ кН}, M = 30 \text{ кНм},$
 $\alpha = 60^\circ, \beta = 60^\circ, \gamma = 30^\circ,$
 $AB = 3 \text{ м}, BC = 4 \text{ м},$
 $CD = 8 \text{ м}, DH = 6 \text{ м},$
 $CK = 2 \text{ м}, CN = 2 \text{ м}.$

Вариант 7

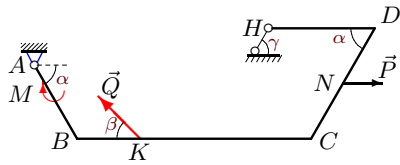
C4.



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

Вариант 8

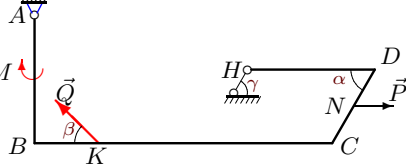
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 22 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 11 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 9

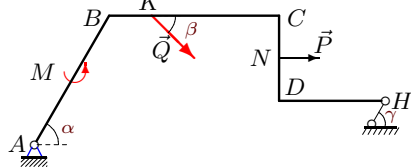
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 35 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 10

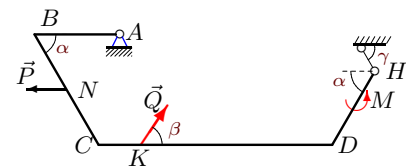
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 14 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 7 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 11

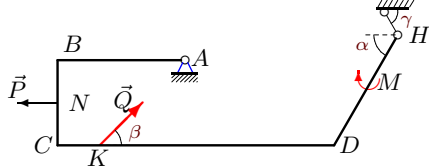
C4.



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

Вариант 12

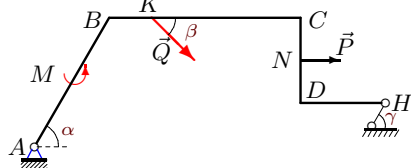
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 34 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 4 \text{ м}$,
 $CD = 13 \text{ м}$, $DH = 6 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 13

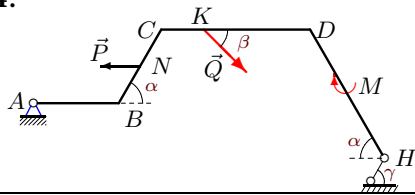
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 13 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 7 \text{ м}$, $BC = 9 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 4 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 14

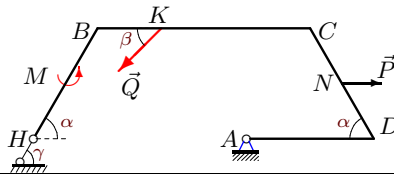
C4.



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

Вариант 15

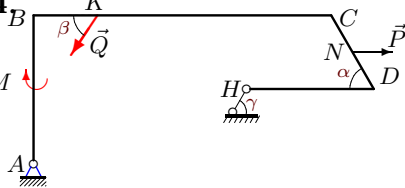
C4.



$\rho = 3 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 21 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 10 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 16

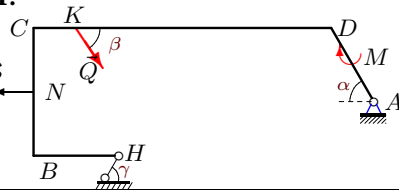
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 32 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 7 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 17

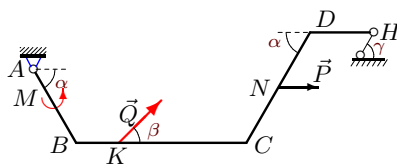
C4.



$\rho = 3 \text{ кН/м}$, $P = 9 \text{ кН}$,
 $Q = 32 \text{ кН}$, $M = 25 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 14 \text{ м}$, $DA = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 18

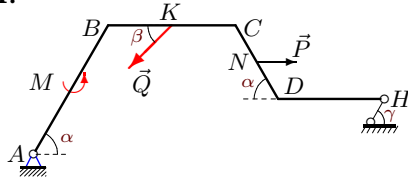
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 21 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 8 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 3 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 19

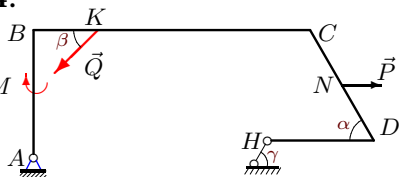
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 18 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 7 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 20

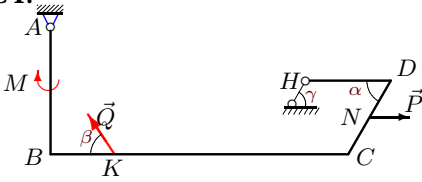
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 6 \text{ м}$, $BC = 13 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 5 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 21

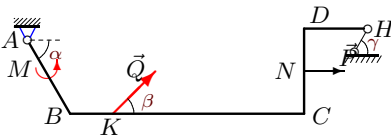
C4.



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

Вариант 22

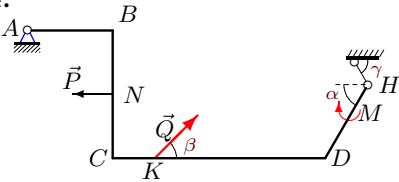
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 15 \text{ кН}$, $M = 50 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 11 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 3 \text{ м}$,
 $BK = 2 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 23

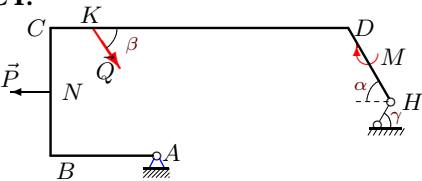
C4.



$\rho = 1 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 31 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 45^\circ$, $\gamma = 30^\circ$,
 $AB = 4 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 10 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 24

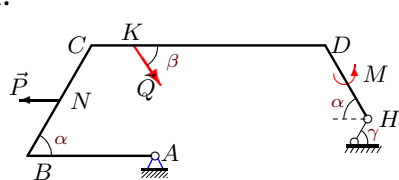
C4.



$\rho = 2 \text{ кН/м}$, $P = 8 \text{ кН}$,
 $Q = 30 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 45^\circ$,
 $AB = 5 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 14 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 25

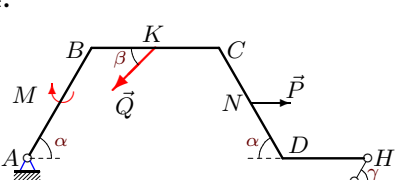
C4.



$\rho = 1 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 16 \text{ кН}$, $M = 30 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 60^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 6 \text{ м}$,
 $CD = 11 \text{ м}$, $DH = 4 \text{ м}$,
 $CK = 2 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 26

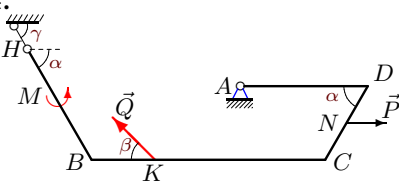
C4.



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

Вариант 27

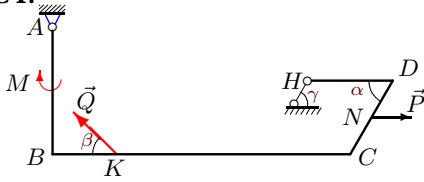
C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 19 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 6 \text{ м}$, $BC = 11 \text{ м}$,
 $CD = 4 \text{ м}$, $DA = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 28

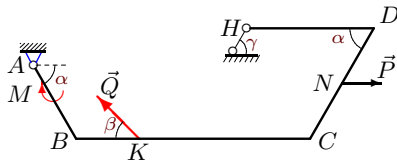
C4.



$\rho = 1 \text{ кН/м}$, $P = 5 \text{ кН}$,
 $Q = 28 \text{ кН}$, $M = 15 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 30^\circ$,
 $AB = 6 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 4 \text{ м}$, $DH = 4 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 2 \text{ м}$.

Вариант 29

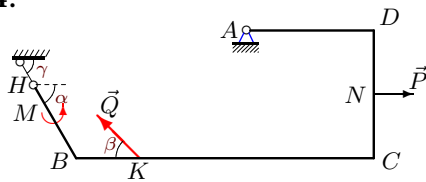
C4.



$\rho = 2 \text{ кН/м}$, $P = 6 \text{ кН}$,
 $Q = 26 \text{ кН}$, $M = 20 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 45^\circ$,
 $AB = 4 \text{ м}$, $BC = 11 \text{ м}$,
 $CD = 6 \text{ м}$, $DH = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Вариант 30

C4.



$\rho = 3 \text{ кН/м}$, $P = 7 \text{ кН}$,
 $Q = 15 \text{ кН}$, $M = 70 \text{ кНм}$,
 $\alpha = 60^\circ$, $\beta = 30^\circ$, $\gamma = 60^\circ$,
 $HB = 4 \text{ м}$, $BC = 14 \text{ м}$,
 $CD = 6 \text{ м}$, $DA = 6 \text{ м}$,
 $BK = 3 \text{ м}$, $CN = 3 \text{ м}$.

Ответы

	$M_A(Q)$	$M_A(P)$	$\Sigma_k M_A(G_k)$	h	X_A	Y_A	R_H
1	17.942	18.144	-428.0	8.864	-25.859	-6.840	46.469
2	152.420	23.383	762.0	-8.660	-54.701	11.772	105.401
3	140.000	17.321	-156.5	9.500	-19.511	12.622	-3.244
4	0.000	24.249	469.5	-14.722	-29.466	39.838	38.292
5	56.959	-10.000	-44.0	6.536	-18.519	12.579	1.842
6	132.502	-12.124	-179.5	9.500	1.155	4.745	3.066
7	28.000	-10.392	-88.0	7.450	-4.189	47.064	2.737
8	-11.000	5.196	-482.0	6.553	-41.739	-13.791	77.487
9	-74.246	25.608	-236.0	7.196	-17.311	-15.568	41.639
10	-112.000	-20.311	-188.2	6.464	-56.052	8.525	44.950
11	62.354	-20.785	-141.0	7.261	3.814	29.597	6.808
12	49.779	-10.000	-15.5	6.036	-25.776	12.769	-1.537
13	-104.000	-24.373	-384.5	10.209	-49.318	22.440	45.339
14	-202.659	12.124	-395.5	13.504	-42.410	29.945	44.877
15	136.556	-20.785	78.0	-8.660	-8.380	72.472	30.458
16	28.862	-42.144	-472.0	4.571	-70.167	11.545	110.545
17	332.554	4.177	846.0	-9.124	-70.442	1.828	126.884
18	110.836	5.196	-164.5	6.500	-23.310	4.730	2.841
19	-5.573	-25.981	-163.2	6.000	-17.059	20.994	27.467
20	114.581	-20.412	-478.0	7.210	-18.759	35.894	56.012
21	-13.263	29.876	-214.0	8.196	-12.941	-13.535	25.913
22	75.000	8.785	-364.0	10.935	-33.877	21.613	21.054
23	263.044	-18.000	-182.0	5.804	-23.089	6.219	-8.278
24	-12.058	24.000	-51.0	5.985	-13.977	77.003	9.868
25	-27.713	18.187	-18.5	3.500	-0.512	41.138	-0.564
26	-12.505	-18.187	-328.0	11.314	-15.112	35.888	33.472
27	-95.000	12.124	88.5	-7.794	14.306	63.097	9.703
28	-103.492	21.340	-214.0	8.196	-13.628	-4.982	37.963
29	-13.000	5.196	-503.0	5.846	-47.684	-23.200	90.793
30	-115.442	21.000	-12.0	-9.928	4.155	85.679	-3.671