

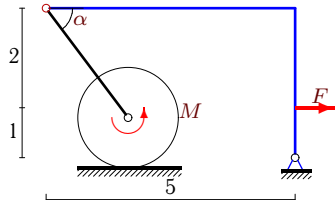
## Трение качения

Механическая система состоит из невесомого уголка, невесомого стержня и цилиндра весом  $P$  радиусом  $R$ . Стержень, ось цилиндра и уголок соединены шарнирно. Цилиндр может кататься без проскальзывания с трением качения  $\delta$ . В каких пределах меняется момент  $M$  при условии равновесия системы?

Кирсанов М.Н. **Решебник. Теоретическая механика**/Под ред. А. И. Кириллова. – М.: ФИЗМАТЛИТ, 2008. – 384 с. (с.80.)

**Задача S-18.1.**

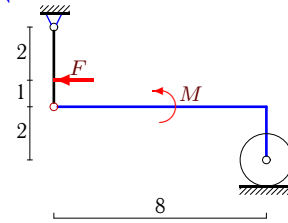
2



$$P = 204 \text{ Н}, F = 11 \text{ Н}, R = 1 \text{ м}, \\ \delta = 2 \text{ см}, \cos \alpha = 0,6.$$

**Задача S-18.2.**

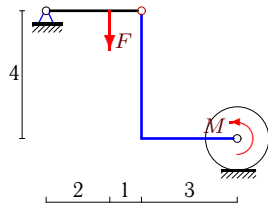
2



$$P = 209 \text{ Н}, F = 3 \text{ Н}, R = 1 \text{ м}, \delta = 1 \text{ см}$$

**Задача S-18.3.**

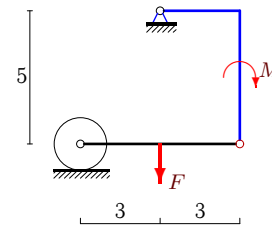
2



$$P = 84 \text{ Н}, F = 24 \text{ Н}, R = 1 \text{ м}, \delta = 1 \text{ см}$$

**Задача S-18.4.**

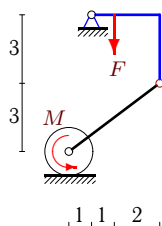
2



$$P = 8 \text{ Н}, F = 24 \text{ Н}, R = 1 \text{ м}, \delta = 1 \text{ см}$$

**Задача S-18.5.**

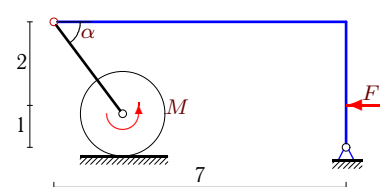
2



$$P = F = 525 \text{ Н}, R = 1 \text{ м}, \delta = 2 \text{ см}$$

**Задача S-18.6.**

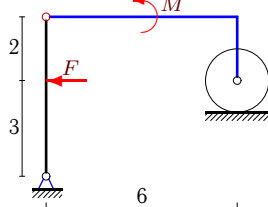
2



$$P = 96 \text{ Н}, F = 19 \text{ Н}, R = 1 \text{ м}, \\ \delta = 1 \text{ см}, \cos \alpha = 0,6.$$

**Задача S-18.7.**

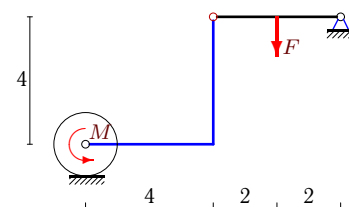
2



$$P = 312 \text{ Н}, F = 5 \text{ Н}, R = 1 \text{ м}, \delta = 1 \text{ см}$$

**Задача S-18.8.**

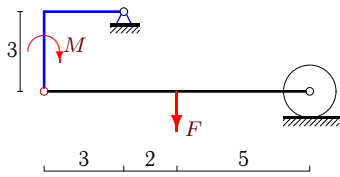
2



$$P = 92 \text{ Н}, F = 16 \text{ Н}, R = 1 \text{ м}, \delta = 1 \text{ см}$$

**Задача S-18.9.**

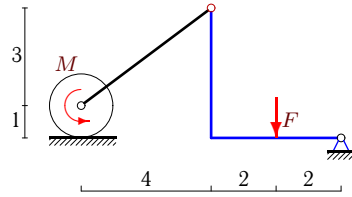
2



$P = 10 \text{ H}, F = 80 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.10.**

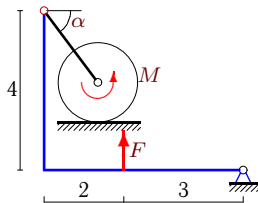
2



$P = 1400 \text{ H}, F = 700 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.11.**

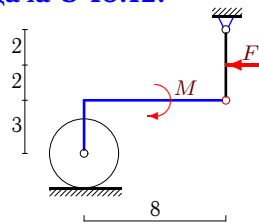
2



$P = 212 \text{ H}, F = 8 \text{ H}, R = 1 \text{ м},$   
 $\delta = 2 \text{ см}, \cos \alpha = 0,6.$

**Задача S-18.12.**

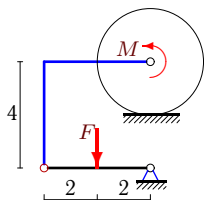
2



$P = 411 \text{ H}, F = 8 \text{ H}, R = 2 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.13.**

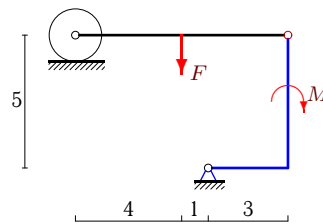
2



$P = 84 \text{ H}, F = 32 \text{ H}, R = 2 \text{ м}, \delta = 1 \text{ см}$

**Задача S-18.14.**

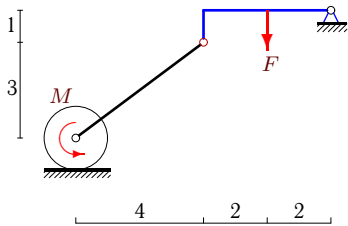
2



$P = 4 \text{ H}, F = 12 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.15.**

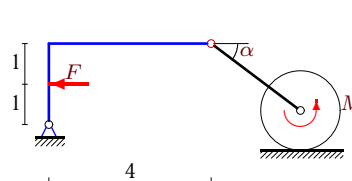
2



$P = F = 200 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.16.**

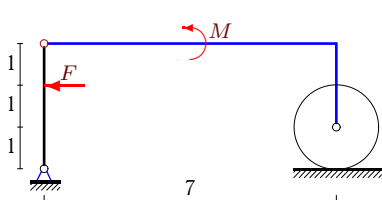
2



$P = 203 \text{ H}, F = 20 \text{ H}, R = 1 \text{ м},$   
 $\delta = 1 \text{ см}, \cos \alpha = 0,8.$

**Задача S-18.17.**

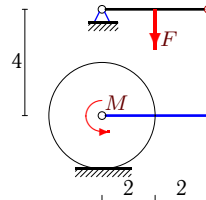
2



$P = 206 \text{ H}, F = 3 \text{ H}, R = 1 \text{ м}, \delta = 1 \text{ см}$

**Задача S-18.18.**

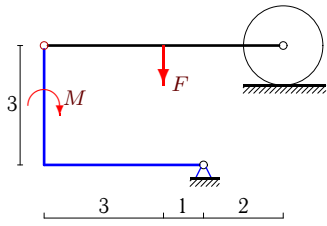
2



$P = 92 \text{ H}, F = 16 \text{ H}, R = 2 \text{ м}, \delta = 1 \text{ см}$

**Задача S-18.19.**

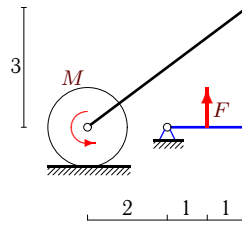
2



$P = 15 \text{ H}, F = 70 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.20.**

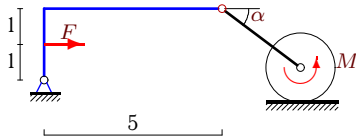
2



$P = 120 \text{ H}, F = 60 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.21.**

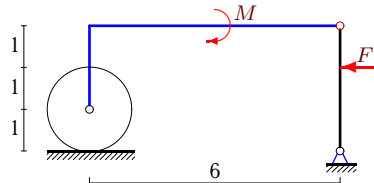
2



$P = 197 \text{ H}, F = 23 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}, \cos \alpha = 0,8.$

**Задача S-18.22.**

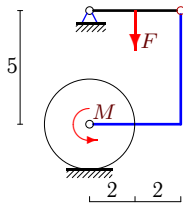
2



$P = 208 \text{ H}, F = 3 \text{ H}, R = 1 \text{ м}, \delta = 1 \text{ см}$

**Задача S-18.23.**

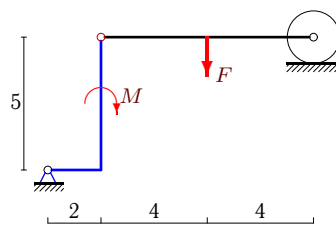
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$P = 90 \text{ H}, F = 20 \text{ H}, R = 2 \text{ м}, \delta = 1 \text{ см}$

**Задача S-18.24.**

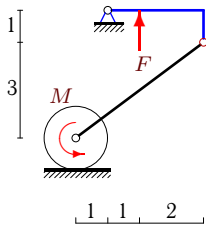
2



$P = 2 \text{ H}, F = 36 \text{ H}, R = 1 \text{ м}, \delta = 1 \text{ см}$

**Задача S-18.25.**

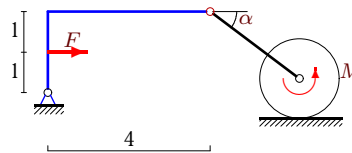
2



$P = F = 65 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.26.**

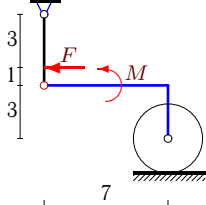
2



$P = 97 \text{ H}, F = 20 \text{ H}, R = 1 \text{ м}, \delta = 2 \text{ см}, \cos \alpha = 0,8.$

**Задача S-18.27.**

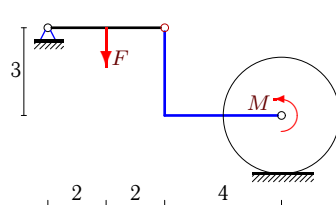
2



$P = 611 \text{ H}, F = 8 \text{ H}, R = 2 \text{ м}, \delta = 2 \text{ см}$

**Задача S-18.28.**

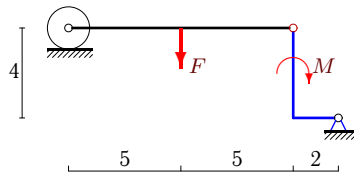
2



$P = 94 \text{ H}, F = 12 \text{ H}, R = 2 \text{ м}, \delta = 1 \text{ см}$

Задача S-18.29.

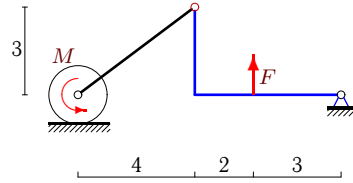
2



$P = 25 \text{ Н}, F = 50 \text{ Н}, R = 1 \text{ м}, \delta = 1 \text{ см}$

Задача S-18.30.

2



$P = F = 225 \text{ Н}, R = 1 \text{ м}, \delta = 2 \text{ см}$

**S-18 Ответы.**  
**Трение качения**

05.05.2013

№	$M_{min}$	$M_{max}$
1	-7	1
2	$-\infty$	68
3	11	13
4	-37	-35
5	-112	-88
6	2	4
7	$-\infty$	66
8	-9	-7
9	117	123
10	-231	-169
11	-13	-5
12	$-\infty$	100
13	-33	-31
14	-17	-19
15	-207	-193
16	-6	-2
17	$-\infty$	38
18	-17	-15
19	143	137
20	-43	-37
21	0	8
22	$-\infty$	52
23	-17	-15
24	-35	-37
25	19	21
26	2	6
27	$-\infty$	59
28	15	17
29	52	48
30	97	103