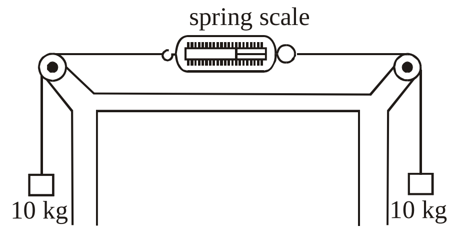
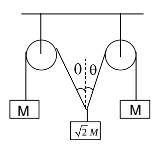
# Connected Bodies

1. **Two 10 kg bodies are attached to a spring balance as shown in figure. The reading of the balance will be**




1) 20 kg-wt    2) 10 kg-wt    3) Zero    4) 5 kg-wt

2. **In the given arrangement, for the system to remain under equilibrium, the '' should be (IIT 2001)**




1) $0^0$    2) $30^0$    3) $45^0$    4) $60^0$

3. **Two blocks of masses 10 kg and 20 kg are connected by a mass less spring and are placed on a smooth horizontal surface. A force of 200 N is applied on 20 kg mass as shown in the diagram. At the instant, the acceleration of 10 kg mass is 12 $ms^{-2}$, the acceleration of 20kg mass is**


1) 4 $ms^{-2}$    2) 12 $ms^{-2}$    3) 20 $ms^{-2}$    4) 8 $ms^{-2}$

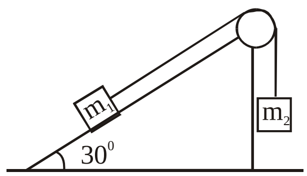
4. **A block of mass 10 kg lying on a smooth horizontal surface is being pulled by means of a rope of mass 2 kg. If a force of 36N is applied at the end of the rope, the tension at the midpoint of the rope is**

1) 33 N    2) 30 N    3) 24 N    4) 12 N

5. **Ten coins each of mass 10 gm are placed one above the other. The reaction force exerted by $7^{th}$ coin from the bottom on the $8^{th}$ coin is (g = 10 m/s$^2$)**

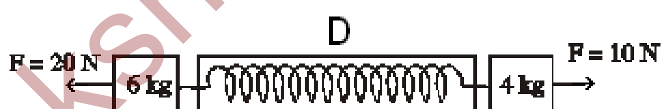
1) 0.3N 2) 0.2N 3) 0.4N 4) 0.7N

6. **A block of mass $m_1$ = 4kg lying on a plane inclined at an angle of $30^0$, is connected to another freely suspended block of mass $m_2$ = 6kg with the help of a string passing over a smooth pulley as shown in the figure. The acceleration of each block is (g =10 m/s$^2$)**



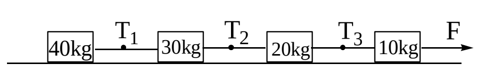

1) 8 m/s$^2$ 2) 5 m/s$^2$ 3) 4 m/s$^2$ 4) 1 m/s$^2$

7. **A dynamometer D is attached to two blocks of masses 6 kg and 4 kg. Forces of 20 N and 10N are applied on the blocks as shown in Fig. The dynamometer reads**



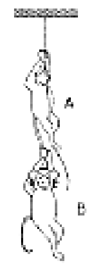

1) 10N 2) 20N 3) 6N 4) 14N

8. **In the arrangement shown in the figure, the ratio of tensions $T_1$: $T_2$: $T_3$ is,**



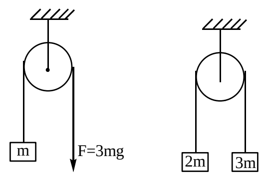

1) 2: 3 : 4 2) 4 : 3 : 2 3) 9 : 7 : 4 4) 4 : 7 : 9

9 . **The monkey B shown in figure is holding on to the tail of the monkey A which is climbing up a rope. The masses of the monkeys A and B are 5 kg and 2 kg respectively. If A can tolerate a tension of 30 N in its tail, what force should it apply on the rope in order to carry the monkey B with it? [Take g =10 ms$^{-2}$].**



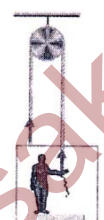

1) Between 70 N and 105 N
2) Between 50 N and 69 N
3) Between 30 N and 50 N
4) Between 106 N and 116 N

**10. If $a_1$ and $a_2$ are the accelerations in the first and second cases, the ratio $a_1 : a_2$ is**



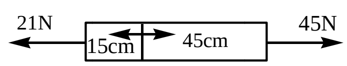

1) 10: 1 2) 20: 1 3) 10: 3 4) 1: 20

**11. A man of mass 60 kg is standing on a weighing machine kept in a box of mass 30 kg as shown in the diagram. If the man manages to keep the box stationary the reading in the weighing machine is**



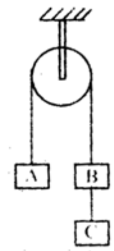
1) 100 N 2) 150 N 3) 200 N 4) 250 N

**12. A uniform rod of length 60 cm and mass 6kg is acted upon by two forces as shown in the diagram. The force exerted by 45 cm part of the rod on 15 cm part of the rod is**



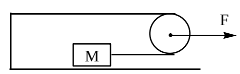

1) 10 N 2) 17 N 3) 27 N 4) 24 N

13. **Three equal masses A, B and C each 2kg connected by strings are arranged as shown in the figure. Assuming the pulley to be smooth and mass less, the tension in the string connecting B and C is nearly**



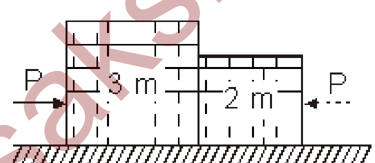

1) 12 N  2) 17.7 N  3) 24.2 N  4) 13.3 N

14. **In the arrangement shown in the figure, the acceleration of the mass is, (Ignore friction)**



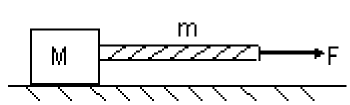

1) $a = \frac{F}{2M}$  2) $a = \frac{F}{M}$  3) $a = \frac{3F}{2M}$  4) $a = \frac{2F}{M}$

15. **Two blocks of masses '3*m*' and '2*m*' are in contact on a smooth table. A force P is first applied horizontally on block of mass '3m' and then on mass '2m'. The contact forces between the two blocks in the two cases are in the ratio**



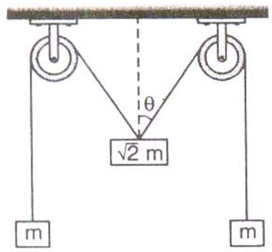

1) 1: 1  2) 2: 1  3) 1 : 3  4) 2 : 3

16. **The block is placed in a frictionless surface in gravity free space. A heavy string of a mass m is connected and force F is applied on the string, then the tension at the middle of rope is**



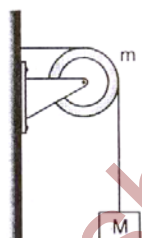
1. $\dfrac{\left(\dfrac{m}{2}+M\right).F}{m+M}$ 2. $\dfrac{\left(\dfrac{M}{2}+m\right).F}{m+M}$ 3. zero 4. $\dfrac{M.F}{m+M}$

**17. The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle should be**




1. $0^0$ 2. $30^0$ 3. $45^0$ 4. $60^0$

**18. A string of negligible mass going over a clamped pulley of mass *m* supports a block of mass M as shown in the figure. The force on the pulley by the clamp is given by**




1. $\sqrt{2}Mg$ 2. $\sqrt{2}mg$ 3. $\sqrt{(M+m)^2+m^2g}$

4. $\left(\sqrt{(M+m)^2+M^2}\right)g$

## Key

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **1) 2** | **2) 3** | **3) 1** | **4) 1** | **5) 1** | **6) 3** | **7) 4** | **8) 4** | **9) 1** |
| **10) 1** | **11) 2** | **12) 3** | **13) 4** | **14) 1** | **15) 4** | **16)1** | **17) 3** | **18) 4** |

## Hints

1. As tension is same both will read same weight of 10 kgwt. i.e.

$$T = \frac{2m_1m_2}{m_1 + m_2} g$$

2. T = Mg $2T\cos\theta = \sqrt{2}Mg$

$$2(Mg)\cos\theta = \sqrt{2}Mg \quad \cos\theta = \frac{\sqrt{2}}{2}$$

$$\cos\theta = \frac{1}{\sqrt{2}}$$

$$\theta = 45^0$$

3. T = 10a = 10 x 12,

T = 120N

200 – T = 20a,

200 – 120 = 20a

80 = 20a,

a = 4 $ms^{-2}$

4. $T = \left(M + \frac{m}{2}\right)a$ a = $\frac{F}{M + m}$

$T = \left(10 + \frac{2}{2}\right).\left(\frac{36}{10+2}\right)$, = 11 x 3 = 33N

5. = 2mg + mg

= 3mg = 3 x $10^{-2}$ x 10 = 0.3 N

6. 6a = 6g - T ——1 4a = T - 4g x $\frac{1}{2}$

4a = T - 2g ——2 10a = 4g

$$a = \frac{4g}{10} = 4ms^{-2}$$

7. 20 – D = 6a, D – 10 = 4a

10 = 10a a = $1ms^{-2}$

D – 10 = 4(1) D = 14N

8. $T_1 = \frac{40}{100}F$ $T_2 = \frac{70}{100}F$ $T_3 = \frac{90}{100}F$

$T_1 : T_2 : T_3 = 4 : 7 : 9$

9. , T = 2g

But given T = 30N ‘A’ is climbing with acc ‘a’

T – 2g = 2a

30 – 20 = 2a, a = $5ms^{-2}$

$T^1 - T - 5g = 5a$ $T^1 = T + 5g + 5a$

$T^1 = 30 + 50 + 5(5)$ $T^1 = 105N$

10. 3mg - mg = $m(a_1)$, $a_1 = 2g$

$$a_2 = \left(\frac{3m-2m}{3m+2m}\right)g$$

$a_2 = \frac{g}{5}$ $\frac{a_1}{a_2} = \frac{10}{1}$

11. T = R + 30g, T + R = 60g

2T = 90g, T = 45g

R = T – 30g, R = 45g – 30g = 15g

R = 150N

12. $F = F_1 + \frac{l_1}{L}(F_2 - F_1)$ $= 45 + \frac{45}{60}(21-45)$

$= 45 + \frac{3}{4}(-24) = 45 - 18 = 27N$

13. $a = \frac{2mg - mg}{3m} = \frac{g}{3}$ $mg - T_2 = ma$

$mg - m\left(\frac{g}{3}\right) = T_2$ $\frac{2mg}{3} = T_2$

$$\frac{2\times2\times10}{3}=T_2\to T_2=\frac{40}{3}=13.3N$$

14. 2T = F $T=\frac{F}{2}$

T= Ma $\frac{F}{2}=Ma$

$$a=\frac{F}{2M}$$

15. $F_1=\left(\frac{2m}{5m}\right)p$ $F_2=\left(\frac{3m}{5m}\right)p$

$F_1=\frac{2}{5}P$ $F_2=\frac{3}{5}P$

$$\frac{F_1}{F_2}=\frac{2}{3}$$

16. $a=\frac{F}{M+m}$

$$T=\left(\frac{m}{2}+M\right)a$$

17. T= mg $2T\cos\theta=\sqrt{2}mg$

18. F = Resultant of three forces