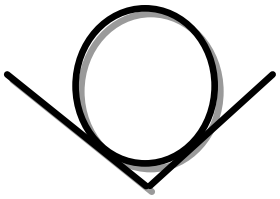
Four Fundamental Forces

Q.1 Ten coins are placed on top of each other on a horizontal table. If the mass of each coin is 10 gm, what is the magnitude and direction of the force on the 7^{th} coin (counted from the bottom) due to all the coins above it? (Take $g = 10\ m/s^2$)

(A) 0.3 N downwards **(B)** 0.3 N upwards **(C)** 0.7 N downwards **(D)** 0.7 N upwards

Free Body Diagram

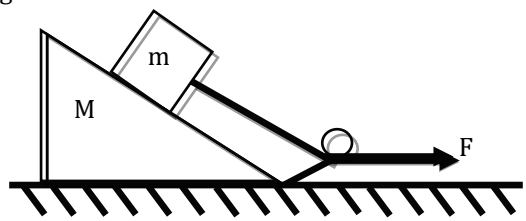
Q.2 A cylinder weighing 'W' is resting on a V-groove as shown in figure. How many forces should be shown in the FBD?



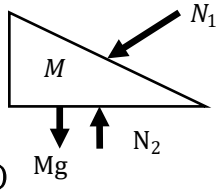
(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

Free Body Diagram

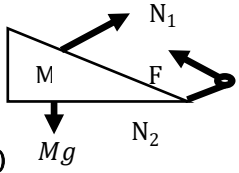
Q.3 The FBD of mass M in the figure shown is



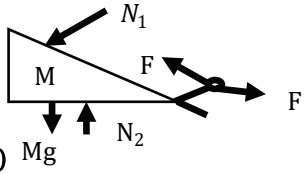
(A)



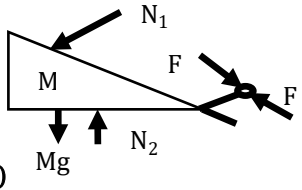
(B)



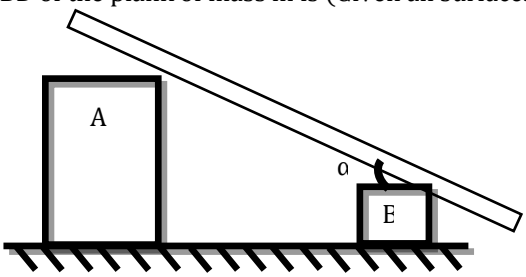
(C)

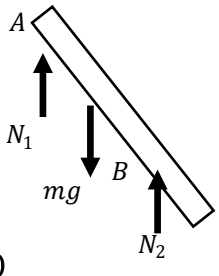


(D)

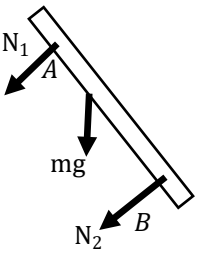


Q.4 For the figure shown, the FBD of the plank of mass m is (Given all surfaces are smooth)

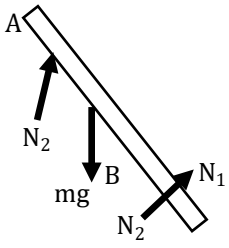




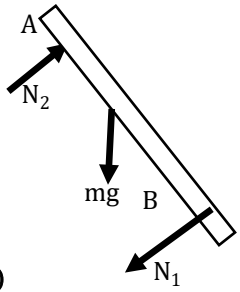
(A)



(B)

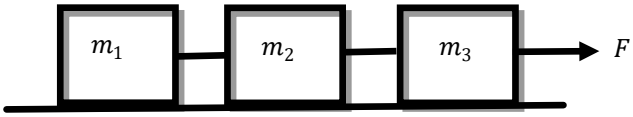


(C)



(D)

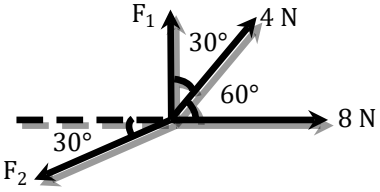
Q.5 How many external forces would appear to act on $(m_2 + m_3)$ if they are considered as a system and m_1 is considered as another system in the figure shown?



(A)1 **(B) 2** **(C) 3** **(D) 4**

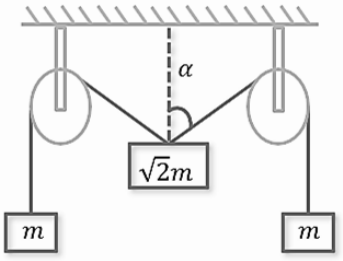
Equilibrium

Q.6 An object is in equilibrium under four concurrent forces in the directions shown in figure. Find the magnitude of F_1 and F_2 (in N).



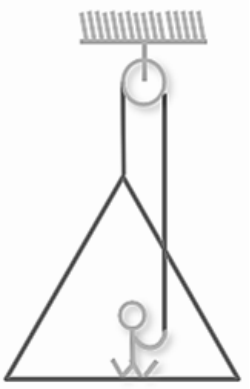
(A) $4\sqrt{3}$ and $20\sqrt{3}$ **(B)** $\frac{4}{\sqrt{3}}$ and $\frac{20}{\sqrt{3}}$ **(C)** $4\sqrt{3}$ and $\frac{20}{\sqrt{3}}$ **(D)** $\frac{4}{\sqrt{3}}$ and $20\sqrt{30}$

Q.7 The pulleys and strings shown in the figure are smooth and of negligible mass. For the system to remain in equilibrium, the angle α should be



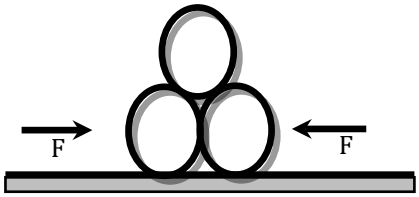
(A) 0° **(B)** 30° **(C)** 45° **(D)** 60°

Q.8 A man of mass 50 kg stands on a frame of mass 30 kg. He pulls on a light rope which passes over a pulley. The other end of the rope is attached to the frame. For the system to be in equilibrium, what force must the man exert on the rope? (Take $g = 10\ m/s^2$)



(A)400 N **(B)**800 N **(C)**300 N **(D)**500 N

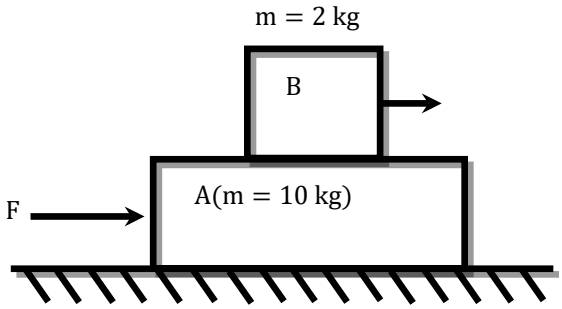
Q.9 Two smooth cylindrical bars weighing W each, lie next to each other in contact. A similar third bar is placed over the two bars as shown in figure. Neglecting friction, the minimum horizontal force on each lower bar necessary to keep them together is



(A) $\frac{W}{2}$ **(B)**W **(C)** $\frac{W}{\sqrt{3}}$ **(D)** $\frac{W}{2\sqrt{3}}$

Newton's Second Law

Q.10 In the figure a force F = 20 N is applied on block A. What would be the acceleration of the block B after 10 seconds from the start. Assume all surfaces are smooth.



(A) $\frac{10}{6}\ m/s^2$ **(B)** $2\ m/s^2$ **(C)**Zero **(D)**Cannot be calculated

WORK SHEET

Inertia

Q.11 Which of Newton's Laws explains why satellites need very little fuel to stay in orbit?

(A) 1st Law **(B)** 2nd Law

(C) 3nd Law **(D)** Law of conservation of mass

Newton's Third Law

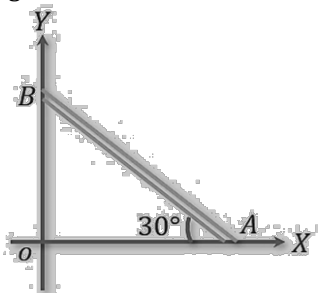
Q.12 A man is at rest in the middle of a pond on perfectly smooth ice. He can get himself to the shore by making use of Newton's

(A) 1st Law **(B)** 2nd Law

(C) 3nd Law **(D)** All the three laws

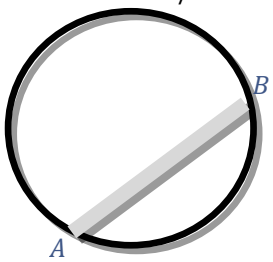
WS_ Removed Question.

Q.13 A rod AB rests with the end A on rough horizontal ground, such that end A is prevented from sliding to the right. End B rests on smooth vertical wall. The rod is uniform and its weight is W. If the rod is in a stationary position as shown in figure, the number of forces acting in the FBD of rod is/are



(A) 4 **(B)** 6 **(C)** 5 **(D)** 8

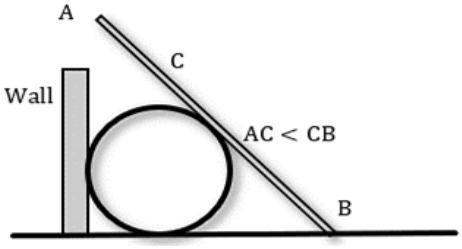
Q.14 A rod AB is placed inside a hollow spherical shell as shown in figure. A force acts between the rod and the shell to prevent the point B from sliding down and another force at A to prevent it from going up. The number of forces to be shown in FBD of the rod is/are



(A) 4 **(B)** 6 **(C)** 5 **(D)** 8

Free Body Diagram

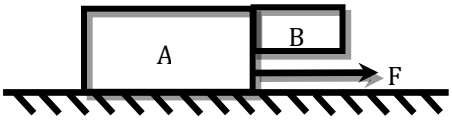
Q.15 A rod AB of weight W_1 is placed over a sphere of weight W_2 as shown in the figure. If friction is absent, the number of forces to be shown on the sphere in its FBD is/are?



(A)3 **(B)**4 **(C)**5 **(D)**6

Q.16 Statements I: Block A is moving on the horizontal surface towards right under action of force F. All surfaces are smooth. At the instant shown, the force exerted by block A on block Bis equal to net force on block B .

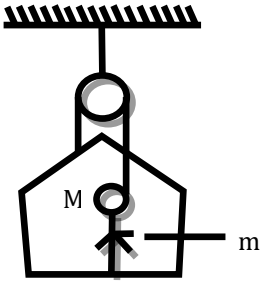
Statement II: From Newton's Third Law, the force exerted by Block A on Block B is equal in magnitude to force exerted by block B on A.

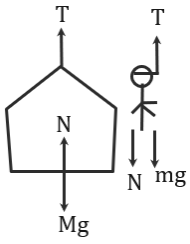


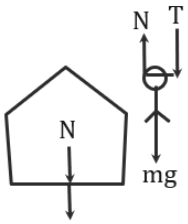
(**A**) Both statements I and II are true and Statement II is correctexplanation of Statement I.
(**B**) Both Statements I and II are true but Statement II is not cirrect explanation of Statement I.
(**C**) Statement I is true and Statemen II is false.
(**D**) Statement I is false and Statement II is true.

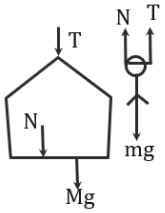
Free Body Diagram

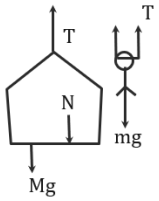
Q.17 The FBD of the frame and the person for the figure shown is



(**A**) 

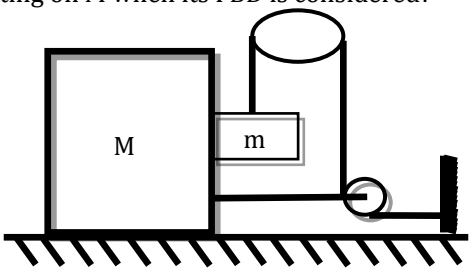
(**B**) 

(C) 

(D) 

Free Body Diagram

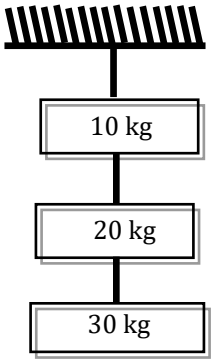
Q.18 How many forces would be acting on M when its FBD is considered?



(A)5 **(B)**6 **(C)**7 **(D)**8

Free Body Diagram

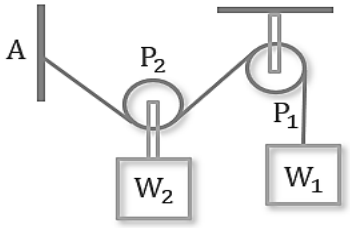
Q.19 If the 10 kg and 20 kg bodies are considered to be system 1 and 30 kg body is considered as system 2. The number of forces that would appear to be acting as external force for system 1 is _____.



Pulley

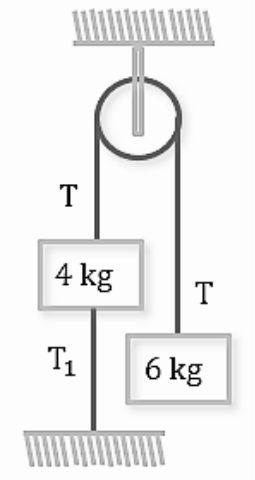
Q.20 In the figure the pulley P_1 is fixed and the pulley P_2 is movable. If $W_1 = W_2 = 100$ N,and the system is in equilibrium, what is the angle $\angle AP_2P_1$?(The pulleys are frictionless)

(A)30°
(B)60°
(C)90°
(D)120°



Tension in a String

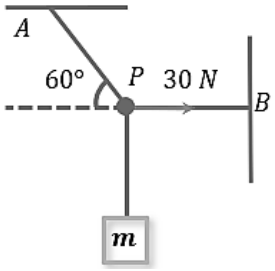
Q.21 Two bodies of mass 4 kg and 6 kg are attached to the ends of a string passing over a pulley as shown in the figure below. The 4 kg mass is attached to the tabletop by another string. The tension in this string T_1 is equal to (take $g = 10\ m/s^2$)



(A)20 N **(B)**25 N **(C)** 10.6 N **(D)**10 N

Free body diagram

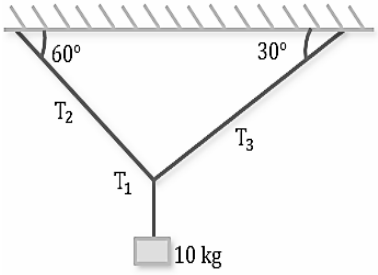
Q.22 Three light strings are connected at the point P. A weight W is suspended from one of the strings. End A of string AP and end B of string PB are fixed as shown. In equilibrium, PB is horizontal and PA makes an angle of 60°with the horizontal. If the tension in PB is 30 N, then the tension in PA and weight W are respectively given by



(A) 60 N, 30 N **(B)** $\frac{60}{\sqrt{3}}$ N, $\frac{30}{\sqrt{3}}$ N **(C)** 60 N, $30\sqrt{3}$ N **(D)** $60\sqrt{3}$ N, $30\sqrt{3}$ N

Tension in a String

Q.23 A block of mass 10 kg is suspended by three strings as shown in the figure. The tension T_2 is (Take $g = 10\ m/s^2$)



(A) 100 N **(B)** $\frac{100}{\sqrt{3}}$ N **(C)** $100\sqrt{3}$ N **(D)** $50\sqrt{3}$ N

Tension in a String

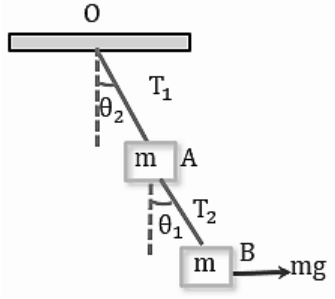
Q.24 In the following figure the masses of the blocks A and B are same and each of equal to m. The tensions in the strings OA and AB are T_2 and T_1 respectively. The system is in equilibrium with a constant horizontal force mg on B. Then T_2 is

(A) mg

(B) $\sqrt{2}$ mg

(C) $\sqrt{3}$ mg

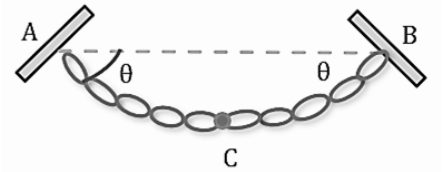
(D) $\sqrt{5}$ mg



Q.25 A flexible chain of mass m hangs between two fixed points A and B at the same level. The inclination of the chain with the horizontal at the two points of support is θ. The tension at the midpoint C of the chain is

(A) $\frac{mg}{\tan\theta}$ **(B)** $\frac{mg}{2\tan\theta}$ **(C)** Zero **(D)** $mg\left(\frac{\sin\theta+\cos\theta}{2}\right)$

Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(C)	(C)	(D)	(D)	(B)	(C)	(A)	(D)	(C)
WORK SHEET										
Q.	1	2	3	4	5	6	7	8	9	10
Sol.	(A)	(B)	(A)	(C)	(B)	(D)	(D)	(C)		(D)
Q.	11	12	13	14	15	16	17	18	19	20
Sol.	(A)	(C)	(D)	(D)	(B)					



ANSWER KEY