నమస్తే తెలంగాణ
నిపుణ II
Guide to Excellence
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పోటీపరీక్షల ప్రత్యేకం
ఆదివారం 8 అక్టోబర్ 2023

దేశంలో మొట్టమొదటి డిజిటల్ రైల్వేస్టేషన్ ఏది?
కాచిగూడ (హైదరాబాద్)

ప్రపంచంలో విద్యుదీకరించబడిన రైల్వే వ్యవస్థలు గల దేశాల్లో భారత రేల్వేల స్థానం?
రెండో స్థానం (మొదటి స్థానంలో రష్యా)

తొలిసారిగా ప్రైవేట్ రంగ సహకారంతో నిర్మించిన రైల్వే మార్గం ?
కొంకణ్ రైల్వే

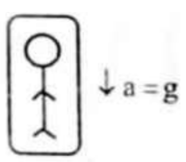
క్వీన్ ఆఫ్ అరేబియా అని ఏ ఓడరేవుని పిలుస్తారు?
కొచ్చిన్

Weight of a body is zero, where 'g'?

Dynamics

నిన్నటి తరువాయి

- Case IV :When the lift is falling freely (i.e.,a=g), apparent weight of the man = m (g – g) = 0.

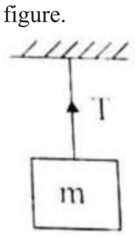


- i.e., Apparent weight becomes equal to zero.

Note :

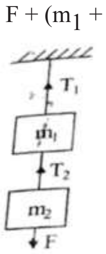
1) When break force is applied for a while it is going up, the apparent weight of the man in a lift decreases. If the lift is moving down the apparent weight of the man in the lift increases.
2) Apparent weight of a body in an orbiting satellite is zero.

- A body of mass 'm' is suspended vertically from a rigid support with the help of string as shown in figure.



a) The tension in the string, T = mg
b) If the string is pulled upwards with an acceleration 'a' than ten sion in the string, T = m (g + a).
c) If the string is lowered down with an acceleration 'a' then tension in the string, T = m (g – a)
d) If the string goes down with an acceleration 'g' then tension in the string T = 0.

- Two blocks of masses m1 and m_2 are suspended vertically from a rigid support with the help of a Strings as shown in figure. The mass m_2 is pulled down with a force F.
- The tension between he masses m_1 and m_2 will be $T_2 = F + m_2g$.
- Tension between the rigid support and mass m1 will be $T_1 = F + (m_1 + m_2)g$.



- **Mass and weight of a body :** The mass of a body is an intrinsic property of the body which measures inertia of the body whereas the weight of a body is the force with it is attracted by the earth towards its centre.

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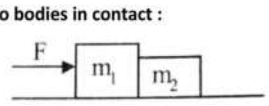
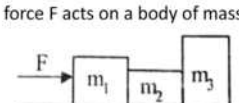
- Mass is a scalar quantity. Weight is a vector quantity. Weight of body is 'mg'.
- The mass remains same at all points. But weight depending upon 'g' varies from place to place.
- The mass of body is measured with a common balance whereas the body weight is measured by a spring balance.
- Weight of a body is zero where g = 0.
- Weight of body is maximum where 'g' is maximum.
- If mass is measured as $m = \frac{F}{a}$, the mass is called Inertial mass.
- If mass is measured as $m = \left(\frac{W}{g}\right)$, the mass is called gravitational mass.
- Inertial and gravitational masses are equal.

➤ **Two bodies in contact :**



a) Acceleration of both the blocks,
$a = \left[\frac{F}{m_1+m_2}\right]$
b) If 'f' is the constant force between m_2 and m_1 then $f = \frac{m_2F}{m_1+m_2}$.
c) If applied force F acts on m_2 then
$f = \frac{m_1F}{m_1+m_2}$.

➤ **Three bodies in contact : Case – I :** If force F acts on a body of mass m_1 then

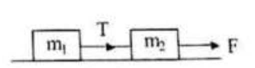


a) Common acceleration,
$a = \frac{F}{m_1+m_2+m_3}$
b) If 'f' is the contact force between m_2 and m_1 then
$f = \frac{(m_2+m_1)F}{m_1+m_2+m_3}$.
c) If f^1 is the contact force between m_3 and m_2 then
$f^1 = \frac{m_3F}{m_1+m_2+m_3}$.

➤ **Case-II :** If the force F acts on body of mass m_3 and m_2 then
a) Common acceleration,
$a = \frac{F}{m_1+m_2+m_3}$
b) If f is the contact force between m_2 and m_3 then
$f = \frac{(m_2+m_1)F}{m_1+m_2+m_3}$.
c) If f^1 is the contact force between m_1 and m_2 then
$f^1 = \frac{m_3F}{m_1+m_2+m_3}$.

➤ **Connecting bodies : Case – (i) :** Two bodies of masses m_1, m_2 are connected by tight string and lying on a smooth horizontal surface, m_2 is pulled forward by a force F.

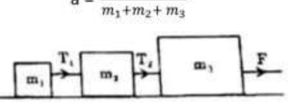
i) The common acceleration, $a = \frac{F}{m_1+m_2}$



ii) Tension, $T = \frac{m_1F}{m_1+m_2}$.

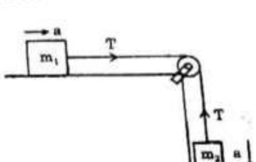
Case – II : Three blocks of masses m_1, m_2, m_3 are connected by tight string and lying on a smooth horizontal surface, m_3 is pulled forward by a force F.

i) The common acceleration,
$a = \frac{F}{m_1+m_2+m_3}$



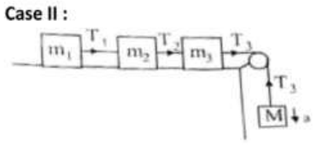
ii) Tension, $T_1 = \frac{m_1F}{(m_1+m_2+m_3)}$
iii) Tension, $T_2 = \frac{(m_1+m_2)F}{(m_1+m_2+m_3)}$.

➤ **Motion of bodies connected by string passing over a pulley :** A block of mass m_1 tied to another block of mass m_2 by light string passing over a pulley. m_2 is hanging freely and m_1 is on horizontal surface.



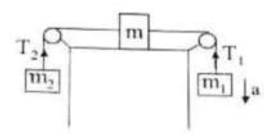
i) The acceleration of system,
$a = \frac{m_2g}{m_1+m_2}$
ii) Tension $T = \frac{m_1m_2g}{(m_1+m_2)}$
iii) Thrust on pulley = $\sqrt{2}$T

Case II :



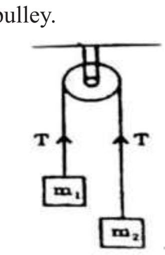
i) The acceleration of system,
$a = \frac{Mg}{(m_1+m_2+m_3+M)}$
ii) Tension, $T_1 = \frac{m_1Mg}{(m_1+m_2+m_3+M)}$
iii) Tension $T_2 = \frac{(m_1+m_2)Mg}{(m_1+m_2+m_3+M)}$
iv) Tension $T_3 = \frac{(m_1+m_2+m_3)Mg}{(m_1+m_2+m_3+M)}$

Case III :



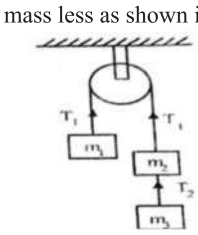
i) The acceleration of system,
$a = \frac{(m_2-m_1)g}{(m_1+m_2+M)}$
i) Tension $T_1 = \frac{m_1g(2m_2+M)}{(m_1+m_2+M)}$
ii) Tension $T_2 = \frac{m_2g(2m_2+M)}{(m_1+m_2+M)}$

At wood's Machine : Two bodies of masses m1 and m2 (m2> m1) are connected by light inextensible string passing over a mass less pulley.



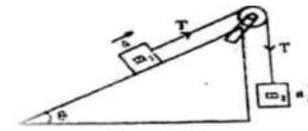
i) Acceleration of the system,
$a = \frac{(m_2-m_1)g}{(m_1+m_2)}$
ii) Tension, $T = \frac{2m_1m_2g}{(m_1+m_2)}$
iii) Thrust on pulley = 2T
$= \frac{4m_1m_2g}{(m_1+m_2)}$
iv) If pulley accelerates up then
$a^1 = \frac{(m_2-m_1)(g+a)}{(m_1+m_2)}$ and
$T^1 = \frac{2m_1m_2(g+a)}{(m_1+m_2)}$

- Three bodies of masses m1 , m2 and m3 are connected by light in extensible string passing over a mass less as shown in fig.



i) Acceleration of system,
$a = \frac{(m_2+m_1-m_1)g}{(m_1+m_2+m_3)}$.
ii) Tension $T_1 = m_1 (a + g)$
iii) Tension $T_2 = \frac{2m_1m_3g}{(m_1+m_2+m_3)}$.

➤ Two bodies of masses m_1 and m_2 are connected by a string passing over pulley.



i) $a = \frac{(m_2-m_1\sin\theta)g}{(m_1+m_2)}$;
ii) Tension in the string is
$T = m_2 (g - a)$
iii) Thrust on pulley
$= \sqrt{T^2 + T^2 + 2T^2\cos(90-\theta)}$
$= \sqrt{2T^2(1+\sin\theta)}$

- A block of mass M is pulled by a rope of mass m by a force F on a smooth horizontal plane.

i) Acceleration of the block, $a = \frac{F}{(M+m)}$,
ii) Force exerted by the rope on the block $= \frac{MF}{(M+m)}$

Examples :

- Two masses m1 and m_2 are connected by light string passing over a smooth pulley. When set free m_1 moves downwards by 1.4m in 2s then find the ratio between m1 and m_2.

Sol : $a = \left[\frac{m_1-m_2}{m_1+m_2}\right]g$

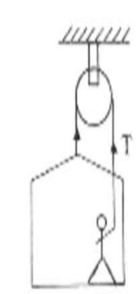
We know that, $s = \frac{1}{2}at^2$

$1.4 = \frac{1}{2}\left[\frac{m_1-m_2}{m_1+m_2}\right] \times 9.8 \times (2)^2$

$\therefore \frac{m_1}{m_2} = \frac{15}{13}$

- A painter in a crate which hangs from a pulley. Mass of the painter is 100kg. when he pulls the rope, the force exerted by him on the floor of the crate is 450N. If the crate weight 25kg then find acceleration of the rope. (g = 10 m/s²)

Sol :For the painter



T + 450 – 100 = 100 a
∴ T – 550 = 110 a ……..(1)
For the crate system,
2T – 125g = 125 a …….(2)
From (1) and (2) Eq. s; a = 2ms-2

Varaprasad
Founder/CEO
The Scholar-Edu-tech
for IIT/NEET
Foundation
6309824365