Answers

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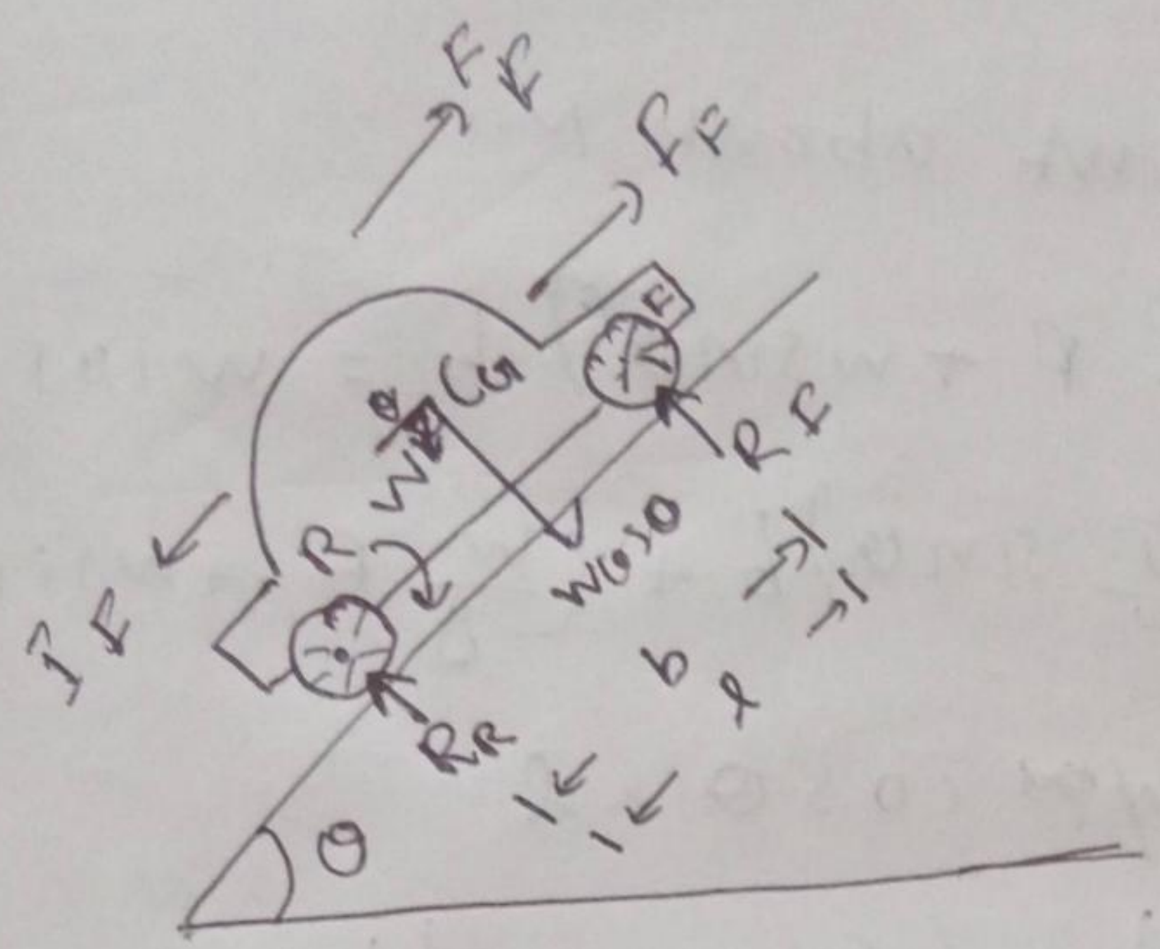

W = weight of the car

Cg = centre of gravity

b = wheel base

F = max. forward acceleration

F_F = max. tractive effort

R = Rear wheel

F = Front wheel

R_F = total normal reaction at ~~Front wh~~ Rear wheel

F_F = total normal reaction at Front wheel

h = height from Cg to road surface

IE (Inertia force)

$= m \cdot F - W \sin\theta$

$mf - mg \sin\theta$

$\frac{W}{g} \cdot f - W \sin\theta$ —— (1)

$\Sigma V = 0$ —— (2)

$\Sigma H = 0$ —— (3)

using (2)

$W \cos\theta = R_F + R_R \longrightarrow 4$

using 3

$F_F = \frac{W}{g} \cdot f + W \sin\theta$ —— (5)

$NRF = \frac{W}{g} \cdot f \cdot W \sin\theta$ —— (6)

$R_R = \frac{W}{g} f + \frac{W}{\mu} \sin\theta$ —— (7)

$$= \frac{w}{r}\left(\frac{f}{g} + \sin\theta\right)$$

taking moment about r

$$R_L \times b + \left(\frac{w}{g} f + w\sin\theta\right) h = w\cos\theta \times l$$

$$\left(\frac{w}{g}\frac{\theta}{r} f + \frac{w}{r}\sin\theta\right) b + \left(\frac{w}{g} f + w\sin\theta\right) \times h$$

$$= w\cos\theta \times l$$

$$\left(\frac{f}{gr} + \frac{\sin\theta}{r}\right) b + \left(\frac{f}{g} + \sin\theta\right) h = \cos\theta\, l$$

$$\frac{b}{r}\left(\frac{f}{g} + \sin\theta\right) + \left(\frac{f}{g} + \sin\theta\right) h = \cos\theta\, l$$

$$\left[\frac{f}{g} + \sin\theta\right]\left[\frac{b}{r} + h\right] = \cos\theta\, l$$

$$\left[\frac{f}{g} + \sin\theta\right]\left[\frac{b}{r} + h\right] = \frac{\cos\theta\, l}{\left[\frac{b}{r} + h\right]} \quad \text{——(8)}$$

$$\frac{f}{g} = \frac{\cos\theta\, l}{\left[\frac{b}{r} + h\right]} - \sin\theta \quad \text{——(8a)}$$

$$F = g\left[\frac{\cos\theta\, l}{\left[\frac{b}{r} + h\right]} - \sin\theta\right] \quad \text{——(9)}$$

$$R_F = \frac{W}{N} \times \frac{\cos\theta\, l}{\left[\frac{b}{N} + h\right]} \qquad \text{——— (10)}$$

$$= \frac{W \cos\theta\, l}{b + 2h}$$

$$R_R = W\cos\theta - R_F$$

$$= W\cos\theta - \frac{W}{N} \frac{\cos\theta\, l}{\left[\frac{b}{N} + h\right]}$$

$$= W\cos\theta \left[1 - \frac{l}{b + 2h}\right]$$

$$= W\cos\theta \left[\frac{b + 2h - l}{b + 2h}\right]$$

$$F_F = \mu R_F = \mu \times \left[\frac{W\cos\theta\, l}{b + 2h}\right]$$

Four wheel drive

$$F = R_R + F_F = 2R_R + 2R_F =$$

$$\Sigma V = 0$$

$$W = R_F + R_R$$

$$\Sigma H = 0$$

$$\left(\frac{W}{g}\right) F = \mu R_R + \mu R_F$$

$$= \mu (R_R + R_F) = \mu W$$

$$\left(\frac{F}{g}\right) = \mu$$

$$\Sigma V = 0$$

$$W = R_R + R_F$$

$$\Sigma_H = 0$$

$$\left(\frac{W}{g}\right)F = F_{RR} + F_{RF}$$

Assumpring slip to occurr at front wheel

First $R_F < R_R$ then

$$\Sigma M_R = 0 \qquad 2MR_F = \left(\frac{W}{g}\right)F$$

$$R_{fb} + (W/g)F_h = W_1$$

2/ $M = 1765\ kg$ $\qquad g = 9.8$

$l = 2.84\ m.$

$a_1 = 1.22\ m$

$a_2 = 1.62\ m$

load on front axis $= F_{AF} = mg\left(\frac{a_2}{l}\right)$

load on rear axis $= F_{AR} = mg\left(\frac{a_1}{l}\right)$

$$F_{AR} = mg\left(\frac{a_1}{l}\right)$$

$$= 1765 \times 9.8 \times \left(\frac{1.22}{2.84}\right)$$

$$= 17297 \times 0.429$$

Load on Rear axis $= 7430.40\ N$

$$F_{AF} = mg\left(\frac{a_2}{l}\right)$$

$$1765 \times 9.8 \left(\frac{1.62}{2.84} \right)$$

$$= 17297 \times 0.570$$

$$= 9866.59 \text{ N}$$

3/ a. Tire parts

i. Beads: Tire beads hold the tire to the rim on outer edge of the wheel. They are made up of copper, brass or bronze plated high tensile steel wires wound into a rubber bund. The tire beads prevent the tire from sliding out of place when the wheel rolls.

ii. Bead filler: It is a rubber compound inside the tire's beads. It provides stability to the lower sidewall and bead area. The density and stiffness of a tire's bead filler help to determine tire's performance characteristics.

iii. Radial cord body: The radial cord body gives the tire strength and transmits cornering forces from the tread to the wheel. Rubber coated fabric cord, called plies, make up the cord body. Body plies can be made of polyster, rayon or nylon.

iv. Inner liner: The inner liner is rubber

compound to the inside of the cord body that retains air under pressure. It has no cord reinforcement and it function like an inner tube. Thats modern can tireless never have inner tubes them. A tires beads, bead filler and inner liner work together to hold air within the tire wall.

v. Belt plies: there are two or more strong layers of cord just under the tread area of the tire. The primary function of belt plies is to provide strength and stability to the tire tread. They play a role is improving tire milage, impact resistance and traction. Steel is the most common cord material used in plies.

vi. Side wall: The area of a tire from the bead to the tread - the side of the tire is called the side wall. It forms a protective covering for the cord body.

vii. Tread: is the portion of a tire that comes in contact with the road surface. The tread compound & it's design have to balance wea traction, handling, fuel economy, resistance & other chara of a tire