Physics

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XI - A

SECTION - A

1. Yes, it can remain in rest if all the forces acting upon it cancels each other.

2. Circular roads are banked, to prevent the unnecessary wearing of tires of vehicles, as the horizontal part of normal reaction provides necessary centripetal force.

3. ~~For a vector to~~ The necessary conditions for a vectors are:
   - The vector should have a magnitude and a direction.
   - A vector should have atleast 3 elements.

4. b) Both A and R are true and R is not the correct explanation of A.

5. c) A is true but R is false

SECTION - B

7. Uniform circular motion is an accelerated motion.
Because, in a uniform circular motion, the speed of body remains the same but the direction of the body changes at every point. Thus the velocity of the body changes as the position changes continously. As the rate of change of velocity is acceleration. Uniform circular motion is an accelerated motion.

SECTION C

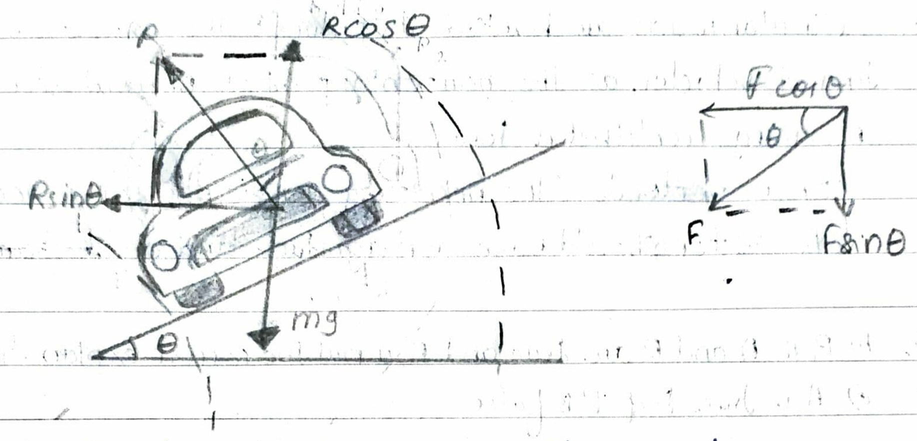
8.
- Kinetic friction opposes the relative motion and has a constant value depending on the surface.
- The value of kinetic friction remains the same ~~as~~ till the normal reaction remains constant.
- The kinetic friction doesnot depend upon the velocity, given the velocity is not ~~too~~ too small or too large.
- The value of kinetic friction directly proportional to the normal reaction between the surfaces. $f_K \propto N$

$$f_K = \mu_K N$$

The coefficient of kinetic friction is the proportionality constant, μ_K. It is defined as the ratio of kinetic friction to the normal reaction.

SECTION - D

10. ~~When a car negotiates a curved the fricti level road, the force of friction between the car and road provided the centripetal force required to keep the car in motion.~~



Consider a car of ~~mass m~~ weight mg and going around a circular ~~road~~ path of radius r with speed v on a road banked at an angle θ. The forces acting on it are :

1. Weight mg acting vertically downwards.
2. Normal reaction R of the road at angle θ.
3. Force of friction acting along the inclined plane

Equating horizontal & vertical forces, respectively.

$$R\sin\theta + F\cos\theta = \frac{mv^2}{r} \longrightarrow (1)$$

$$mg + F\sin\theta = R\cos\theta, \text{ where } F = \mu R$$

or $$R\cos\theta - F\sin\theta = mg \longrightarrow (2)$$

Dividing (1) by (2)

$$\frac{R\sin\theta + F\cos\theta}{R\cos\theta - F\sin\theta} = \frac{v^2}{rg}$$

Dividing denominator & numerator of LHS by $R\cos\theta$, we get.

$$\frac{\tan\theta + \frac{F}{R}}{1 - \frac{F}{R}\tan\theta} = \frac{v^2}{rg}$$

or $$\frac{\tan\theta + \mu}{1 - \mu\tan\theta} = \frac{v^2}{rg} \qquad \left[\because \mu = \frac{F}{R}\right]$$

or $$v^2 = rg\left[\frac{\mu + \tan\theta}{1 - \mu\tan\theta}\right]$$ or $$v = \sqrt{rg \cdot \frac{\mu + \tan\theta}{1 - \mu\tan\theta}}$$