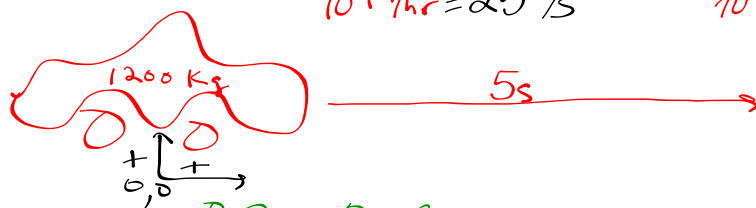


51. A 1200-kg car slows down from 90 km/h to 70 km/h in about 5.0 seconds on the level when it is in neutral. Approximately what power (watts and hp) is needed to keep the car traveling at a constant 80 km/h?

$$90 \text{ km/hr} = 25 \text{ m/s}$$

$$70 \text{ km/hr} = 19.4 \text{ m/s}$$



$$\frac{1}{2}mv_0^2 + mgh_0 + \frac{1}{2}kx_0^2 + W_{nc} = \frac{1}{2}mv^2 + mgh + \frac{1}{2}kx^2$$

$$m = 1200 \text{ kg}$$

$$v_0 = 25 \text{ m/s}$$

$$v = 19.4 \text{ m/s}$$

$$W_{nc} = \frac{1}{2}(1200)(19.4^2) - \frac{1}{2}(1200)(25^2)$$

$$W_{nc} = -149000 \text{ J}$$

$$\boxed{\quad} \leftarrow F_{fr} \cdot d = W_{fr} \cdot d$$



$$\sum F_x = F_{app} + F_{fr} = ma = 0$$

$$F_{app} = -F_{fr}$$

$$\text{Power} = \frac{\text{Work}}{\text{time}} = \frac{\text{Force} \cdot \text{dist.}}{\text{time}}$$

$$P_{fr} = \frac{-149000}{5} = 29,800 \text{ Watts}$$

$$P_{fr} = \frac{W}{t} = \frac{F_{fr} \cdot d}{t} = 29,800 \text{ Watts}$$

$$F_f = \frac{29,800 t}{d}$$

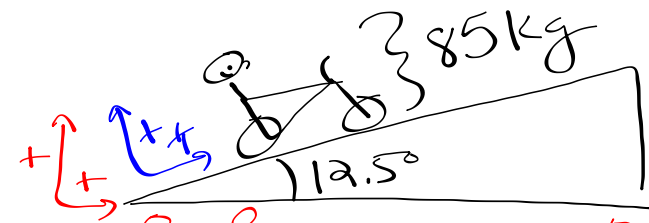
$$F_{app} = \frac{29,800 t}{d}$$

$$P_{app} = F_{app} \cdot v \quad \leftarrow \text{(if } v \text{ is constant)}$$

$$\frac{29,800 t}{d} \cdot \frac{d}{t}$$

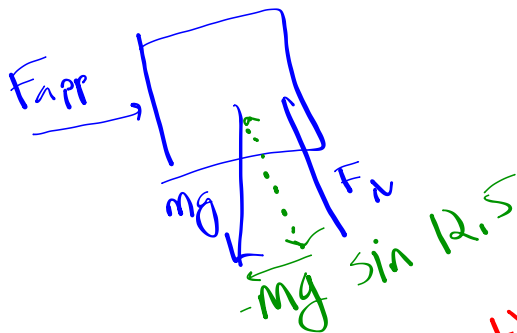
$$P_{app} = 29,800 \text{ J}$$

55. How fast must a cyclist climb a 12.5° hill to maintain a power output of 0.23 hp? Ignore friction and assume the mass of the cyclist and bicycle is 85 kg.



$$P = 0.23 \text{ hp} \cdot \frac{750 \text{ W}}{\text{hp}} = 172.5 \text{ W}$$

$$\cancel{\frac{1}{2}mv_0^2} + mgh_0 + \cancel{\frac{1}{2}kx_0^2} + W_{nc} = \cancel{\frac{1}{2}mv^2} + mgh + \cancel{\frac{1}{2}kx^2}$$



$$\Sigma F_x = F_{app} + F_{gx} = ma$$

$$F_{app} + F_{gx} = 0$$

$$F_{app} - mg \sin 12.5 = 0$$

$$F_{app} = (85)(9.8)(\sin 12.5) = 180.3 \text{ N}$$

$$P = F \cdot v \quad (v \text{ constant})$$

$$172.5 = 180.3 \cdot v$$

$$v = 0.96 \frac{\text{m}}{\text{s}}$$

Virtual energy lab:

- Initial calculations/predictions
 - Questions for #3
 - Initial variables, predictions, actual #'s for 4
 - Paragraph (thoughtful) for #5
- show
work
equations,
clear
diagrams