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Mathematics 9709/42

Paper 4 Mechanics October/November 2020

Question No (2)

2 A car of mass 1800 kg is travelling along a straight horizontal road. The power of the car's engine is constant. There is a constant resistance to motion of 650 N.

(a) Find the power of the car's engine, given that the car's acceleration is $0.5\,\text{m s}^{-2}$ when its speed is $20\,\text{m s}^{-1}$.

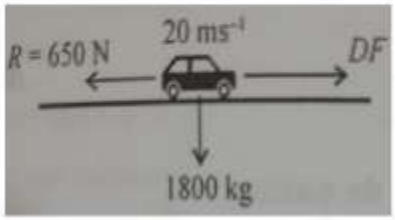
(b) Find the steady speed which the car can maintain with the engine working at this power.

Solution:

(a)

By Question statement

$R = 650\ N$ (resistance)



$m = 1800\ kg$

$a = 0.5\ ms^{-2}$

$v = 20\ ms^{-1}$

Driving force, $DF = \frac{P}{v} = \frac{P}{20}$

Applying Newton 2nd law of motion

resultant force $= ma$ $\because F = ma$

$DF - R = ma$

$\frac{P}{20} - 650 = 1800(0.5)$ $\because DF = \frac{P}{20}$

$\frac{P}{20} - 650 = 900$

$\frac{P}{20} = 900 + 650$

$\frac{P}{20} = 1550$

$\Rightarrow P = 1550 \times 20$

$= 31\,000\ w$

$P = 31\ kw$

(b) As at steady speed

$DF = R$

$\frac{P}{v} = R$ $\therefore DF = \frac{P}{v}$

$\frac{31000}{v} = 650$ now P is 31000 part (a)

$v = \frac{31000}{650}$

$v = 47.7\ ms^{-1}$