Cambridge International AS & A Level

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Mathematics   9709/42

Paper 4 Mechanics   May/June 2020

Question No(1)

1   A tram starts from rest and moves with uniform acceleration for 20 s. The tram then travels at a constant speed, $V\,\mathrm{m\,s}^{-1}$, for 170 s before being brought to rest with a uniform deceleration of magnitude twice that of the acceleration. The total distance travelled by the tram is 2.775 km.

   (a)   Sketch a velocity-time graph for the motion, stating the total time for which the tram is moving.

   (b)   Find V.

   (c)   Find the magnitude of the acceleration.

Solution:

(a) As given in the question statement
deceleration is TWICE the acceleration

⇒ Time taken for deceleration = half time of acc

= 10 sec   ∵ Full time of ac
is 20 sec

$v(ms^{-1})$
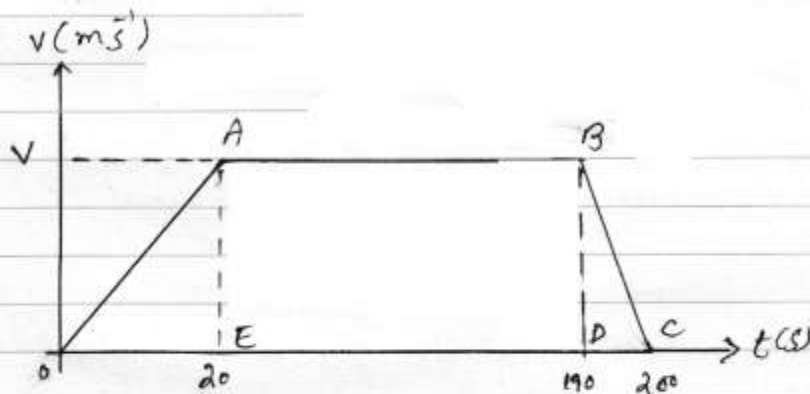
(b)

Distance travelled = Area of Trapezium OABC

$2.775 \ km = \frac{1}{2}$ (sum of parallel sides) × height

$2.775 \times 1000 \ m = \frac{1}{2} (|OC| + |AB|) \times |AE|$

$2775 = \frac{1}{2} (200 + 170) \times v$

$2775 = 185 \ v$

$v = \frac{2775}{185}$

$v = 15 \quad ms^{-1}$

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(C)

$$\text{Acceleration} = \frac{\text{velocity}}{\text{time}}$$

$$= \frac{V}{20}$$

$$= \frac{15}{20} \qquad \because V = 15 \text{ part(b)}$$

$$\text{Acceleration} = 0.75 \text{ ms}^{-2}$$