Solutions to Problems Sets of Chapter 2

The University of Jordan/Physics Department

Prof. Mahmoud Jaghoub

أ.د. محمود الجاغوب

Q5] $\bar{v} = 25 \frac{km}{h}$ is constant.

$$\bar{v} = \frac{\Delta x}{\Delta t} \Rightarrow \Delta t = \frac{\Delta x}{\bar{v}}$$

$$\Delta t = \frac{3.5\ km}{25\ \frac{km}{h}} = 0.14\ h.$$

Q7] motion at constant speed of $90 \frac{km}{h}$ for 180 km

$$\bar{v}_1 = \frac{D_1}{\Delta t} = \frac{180}{\Delta t} = 95 \Rightarrow \Delta t_1 = \frac{180}{95} = 1.895\ h$$

Total time of trip $= 4.5\ h = \Delta t_1 + \Delta t_2$

$\therefore\ \Delta t_2 = 4.5 - \Delta t_1 = 2.605\ h$

$\bar{v}_2 = \frac{D_2}{\Delta t_2} \Rightarrow D_2 = \bar{v}_2\ \Delta t_2 = 65\ \frac{km}{h} \times 2.605\ h$

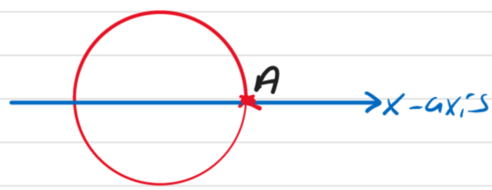
$\therefore\ D_2 = 169.3\ km$

Total distance $= D_1 + D_2 = 180 + 169.3 = 349.3\ km$

$\bar{s} = \frac{\text{total distance covered}}{\text{total time}} = \frac{349.3\ km}{4.5\ \ h}$

$\bar{s} = 77.6\ km/h$.

Q9] One complete lap (circle) is 400 m.



8 complete laps $\Rightarrow$

distance covered $= 8 \times 400 = 3200\ m$.

average speed $\bar{s} = \frac{\text{total distance}}{\text{total time}} = \frac{3200\ m}{14.5\ min}$

$\bar{s} = 220.7\ m/min$

8 complete laps ⇒ he starts from point A and returns to the same point A ⇒ returns to the same position he started from.

$$\therefore \quad \Delta x = x_f - x_i = 0$$

Whenever we return to the same point ⇒ $\Delta x = 0$

$$\therefore \quad \bar{v} = \frac{\Delta x}{\Delta t} = \frac{0}{14.5} = 0 .$$

Q11]

$v_c = 95$ km/h

$v_t = 75$ km/h

$$v_c = \frac{d_c}{\Delta t} , \quad v_t = \frac{d_t}{\Delta t} ,$$

The distance travelled by the car is equal to the distance travelled by the truck plus 210 m.

$$\Rightarrow d_c = d_t + 210$$

but Δt is the same for both.

$$\therefore \quad \Delta t = \frac{d_c}{v_c} = \frac{d_t}{v_t} \Rightarrow \frac{d_t + 210}{95} = \frac{d_t}{75}$$

$$\therefore \quad 75(d_t + 210) = 95\, d_t$$

$$75\,d_t + 75 \times 210 = 95\,d_t$$

$$\therefore \quad 75 \times 210 = 20\,d_t \Rightarrow d_t = \frac{210\,m \times 75\,\frac{km}{h}}{20\,km/h}$$

$$\therefore \quad d_t = 787.5\,m$$

Now use $\dfrac{d_t}{v_t} = \Delta t \Rightarrow \Delta t = \dfrac{787.5\,m}{75\,\frac{km}{h}}$

$$\Delta t = \frac{787.5\,m}{75\,\frac{km}{h} \times \frac{1000\,m}{km}} = 10.5 \times 10^{-3}\,h$$

$$= 10.5 \times 10^{-3}\,h \times \frac{3600\,s}{h}$$

$$\Delta t = 37.8\,s.$$

Q20] 65 km/h $\rightarrow$ 120 km/h

$$65\,\frac{km}{h} = 65\,\frac{km}{h} \times \frac{1000\,m}{km} \times \frac{h}{3600\,s} = 18.1\,m/s$$

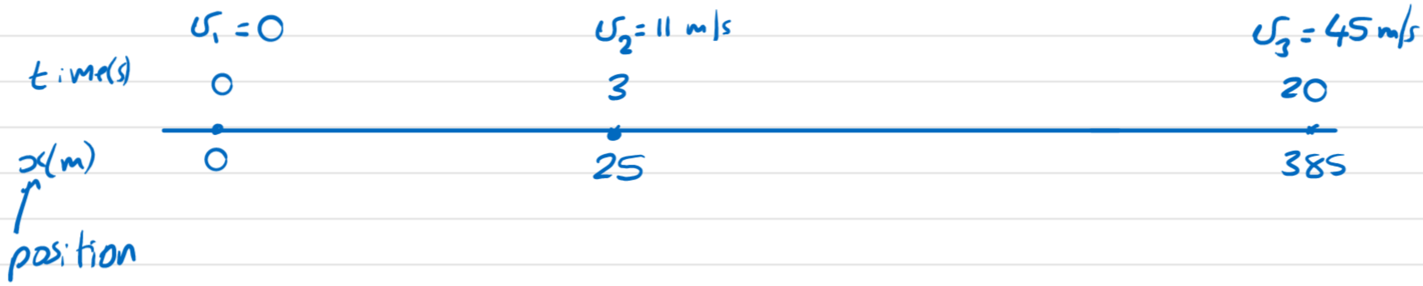
$$120\,\frac{km}{h} = 120\,\frac{km}{h} \times 1000\,\frac{m}{km} \times \frac{h}{3600\,s} = 33.3\,m/s$$

$\therefore \quad \bar{a} = \frac{\Delta v}{\Delta t} \Rightarrow \Delta t = \frac{\Delta v}{\bar{a}} = \frac{33.3 - 18.1}{1.8} = 8.4 \text{ s}$

Note that $\bar{a}$ and v must be given in the same units, $\frac{m}{s^2}$ and $\frac{m}{s}$ or $\frac{km}{h^2}$ and $\frac{km}{h}$.

I choose $\frac{m}{s^2}$ and $\frac{m}{s}$.

Q21]



ⓐ $\bar{v}_{3-20} = \frac{\Delta x}{\Delta t} = \frac{385 - 25}{20 - 3} = 21.2 \text{ m/s}$

ⓑ $\bar{a}_{3-20} = \frac{\Delta v}{\Delta t} = \frac{45 - 11}{20 - 3} = \frac{34}{17} = 2 \text{ m/s}^2$