PQ 7b

Questions and Answers

Q1

- A train started from a station and accelerated at 0.5 m s^{-2} to reach its top speed of 50 m s^{-1} and maintained this speed for 90 minutes.
- As the train approached the next station the driver applied the brakes uniformly to bring the train to a stop in a distance of 500 m.
- a) Calculate how long it took the train to reach its top speed.
- b) Calculate how far it travelled at its top speed.
- c) Calculate the acceleration experienced by the train when the brakes were applied.
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Q1 continued

(i)$v = u + at$

- $50 = 0 + 0.5t$
- $t = 50/0.5 = 100$ s

(i)$s = ut + ½ at^2$ (but $a = 0$)

- $s = 50 \times (90 \times 60) = 270000$ m

(i)$v^2 = u^2 + 2as$

- $0 = 50^2 + 2a(500)$
- $a = -2500/1000 = -2.5$ m s^{-1}

Q2

- A skateboarder starts from rest at the top of a ramp and accelerates down it. The ramp is 25 m long and the skateboarder has a velocity of 12.2 m s^{-1} at the bottom of the ramp.
- Calculate the acceleration of the skateboarder on the ramp.
- $v^2 = u^2 + 2as \quad \Rightarrow \quad (12.2)^2 = 0 + 2a(25)$
- $a = 2.98$ m s^{-2}

Q3

- A car is travelling at a velocity of 25 m s^{-1} when the engine is then turned off; calculate how far the car will travel before coming to rest if the deceleration is 1.47 ms^{-2}?
- $v^2 = u^2 + 2as$
- $0 = 25 + 2(-1.47)\ s$ or $s = 213$ m

Q4

- An aircraft was travelling at a speed of 60 m s^{-1} when it landed on a runway. It took two minutes to stop. Calculate the acceleration of the aircraft while coming to a stop.
- $v = u + at \qquad \Rightarrow 0 = 60 + a\,(120)$
- $\Rightarrow a = -\,0.5\ m\ s^{-2}$

Q5

- Four points *a*, *b*, *c* and *d* lie on a straight level road.
- A car, travelling with uniform retardation, passes point *a* with a speed of 30 m/s and passes point *b* with a speed of 20 m/s.
- The distance from *a* to *b* is 100 m. The car comes to rest at *d*.
- Find

(i) the uniform retardation of the car

(ii) the time taken to travel from *a* to *b*

(iii) the distance from *b* to *d*

(iv) the speed of the car at *c*, where *c* is the midpoint of [*bd*].

Q5 continued

- i) $v^2 = u^2 + 2as$
- $20^2 = 30^2 + 2(a)(100)$
- $-500 = 200\ a$
- $a = -2.5\ m\ s^{-2}$
-
- ii) $v = u + at$
- $20 = 30 – 2.5\ t$
- $T = 4\ s$
-
- iii) $v^2 = u^2 + 2as$
- $0^2 = 20^2 + 2(-2.5)(s)$
- $s = 80\ m$
-
- iv) $v^2 = u^2 + 2as$
- $= 20^2 + 2(-2.5)(40)$
- $= 200$
- $v = 10\sqrt{}$ or $14.1\ m\ s^{-1}$

Q6

- A car travels from p to q along a straight level road.
- It starts from rest at p and accelerates uniformly for 5 seconds to a speed of 15 m/s.
- It then moves at a constant speed of 15 m/s for 20 seconds.
- Finally the car decelerates uniformly from 15 m/s to rest at q in 3 seconds.

(i) Find the uniform acceleration of the car.

(ii) Find the uniform deceleration of the car.

(iii) Find $|pq|$, the distance from p to q.

(iv) Find the speed of the car when it is 13.5 metres from p.

Q6 continued

- i) $v = u + at$
- $15 = 0 + 5\ a$
- $a = 3\ m\ s^{-2}$
-
- ii) $v = u + at$
- $0 = 15 + 3a$
- $a = - 5$
- deceleration is $5\ m\ s^{-2}$
-
- iii) distance = ½ (5)(15) + (20)(15) + ½ (3)(15)
- = 37.5 + 300 + 22.5
- = 360 m
-
- iv)$v^2 = u^2 + 2as$
- $= 0 + 2(3)(13.5)$
- $= 81\ m$
- $v = 9\ m\ s^{-1}$