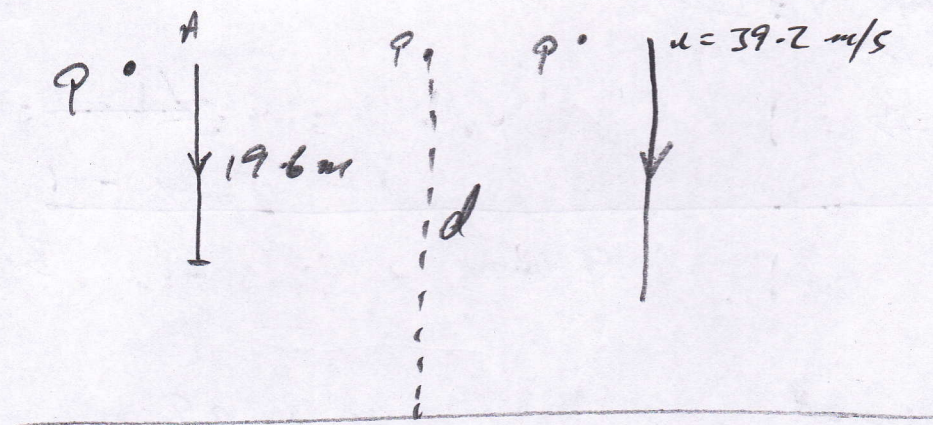


(a)



A:

$$u = 0 \text{ m/s}^{-1}$$

$$S = 19.6 \text{ m}$$

$$g = 9.8 \text{ m/s}^{-2}$$

$$t = ?$$

$$S = ut + \frac{1}{2}at^2$$

$$19.6 = \frac{1}{2}(9.8)t^2$$

$$39.2 = 9.8t^2$$

$$2 \text{ sec.} = t$$

B:

$$u = 39.2$$

$$a = 9.8 \text{ m/s}^2$$

$$S = ut + \frac{1}{2}gt^2$$

$$d = 39.2t + \frac{1}{2}(9.8)t^2$$

A:

$$d = 0 + \frac{1}{2}(9.8)(t+2)^2$$

$$39.2t + \frac{1}{2}(9.8)t^2 = \frac{1}{2}(9.8)(t+2)^2$$

$$\Rightarrow 4t + \frac{1}{2}t^2 = \frac{1}{2}(t+2)^2$$

$$\Rightarrow 8t + t^2 = t^2 + 4t + 4$$

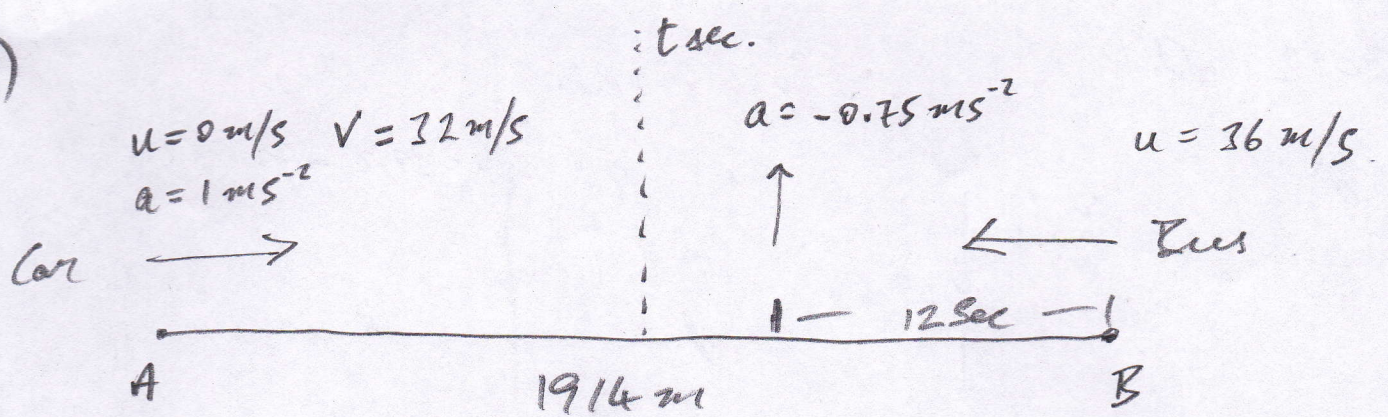
$$\Rightarrow 4t = 4$$

$$\Rightarrow t = 1 \text{ sec.}$$

$$d = 0 + \frac{1}{2}(9.8)(t+2)^2$$

$$\Rightarrow d = 44.1 \text{ m}$$

(b)(i)



Car: $v = u + at$

$$32 = 0 + t$$

$$32 \text{ sec} = t$$

$$v^2 = u^2 + 2as$$

$$32^2 = 0^2 + 2(1)s$$

$$\Rightarrow 512 \text{ m} = s$$

= Distance accelerating.

Bus: $s = ut + \frac{1}{2}at^2$

$$= 36t + \frac{1}{2}(0)t^2$$

$$= 36t$$

$$= 36(12)$$

$$= 432 \text{ m}$$

= Distance before decelerating

$$1914 = 512 + \text{distance at constant speed (Car)} + 432 + \text{distance decelerating (bus)}$$

$$= 512 + (ut + \frac{1}{2}at^2) + 432 + (ut + \frac{1}{2}at^2)$$

$$= 512 + [32(t-32) + \frac{1}{2}(0)t^2] + 432 + [36(t-12) + \frac{1}{2}(-\frac{3}{4})(t-12)^2]$$

$$= 512 + 32t - 1024 + 432 + 36t - 432 + \frac{1}{2}(-\frac{3}{4}) \times (t^2 - 24t + 144)$$

$$= -512 + 68t - \frac{3}{8}t^2 + 9t - 54$$

$$1914 = -\frac{3}{8}t^2 + 77t - 566 \Rightarrow 0 = 3t^2 - 616t + 19840$$

$$a = 3$$

$$b = -616$$

$$c = 19840$$

$$t = \frac{616 \pm \sqrt{(-616)^2 - 4(3)(19840)}}{2(3)}$$

$$= \frac{616 \pm \sqrt{141376}}{6}$$

$$= \frac{616 \pm 376}{6}$$

$$= 40 \text{ or } 165.3 \text{ sec.}$$

$$t = 40 \text{ sec.}$$

(ii) After passing each other $t = 8 \text{ sec.}$ (48-40)

Car:
$$s = ut + \frac{1}{2}at^2$$
$$= 32(8) + \frac{1}{2}(0)t^2$$
$$= 256 \text{ m}$$

Bus: Velocity of the bus when they meet:

$$V = u + at$$
$$= 36 + \left(-\frac{3}{4}\right)(40-12)$$
$$= 15 \text{ m/s}$$

Distance after they meet:

$$s = ut + \frac{1}{2}at^2$$
$$= 15(8) + \frac{1}{2}\left(-\frac{3}{4}\right)(8)^2$$
$$= 96 \text{ m}$$

$$\Rightarrow \text{Distance apart} = 256 + 96$$
$$= 352 \text{ m.}$$