2000 8

1. **(b)** Two particles P and Q, each having constant acceleration, are moving in the same direction along parallel lines. When P passes Q the speeds are 23 m/s and 5.5 m/s, respectively. Two minutes later Q passes P, and Q is then moving at 65.5 m/s.

Find **(i)** the acceleration of P and the acceleration of Q

(ii) the speed of P when Q overtakes it

(iii) the distance P is ahead of Q when they are moving with equal speeds.

(i) Q $v = u + ft$

$65.5 = 5.5 + f(120)$

$f = \frac{1}{2}$ m/s^2 — 5

$s = ut + \frac{1}{2}ft^2$

$= 5.5(120) + \frac{1}{2}\left(\frac{1}{2}\right)(120)^2$

$= 4260$ m — 5

P $s = ut + \frac{1}{2}ft^2$

$4260 = 23(120) + \frac{1}{2}a(120)^2$

$a = \frac{5}{24}$ m/s^2 — 5

(ii) $v = u + at$

$= 23 + \frac{5}{24}(120)$

$= 48$ m/s — 5

(iii) $V_P = V_Q$

$23 + \frac{5}{24}t = 5.5 + \frac{1}{2}t \quad \Rightarrow t = 60$ s — 5

$S_P = 23(60) + \frac{1}{2}\left(\frac{5}{24}\right)(60)^2 = 1755$

$S_Q = 5.5(60) + \frac{1}{2}\left(\frac{1}{2}\right)(60)^2 = 1230$

distance $= 1755 - 1230 = 525$ m. — 5

30