**5.**
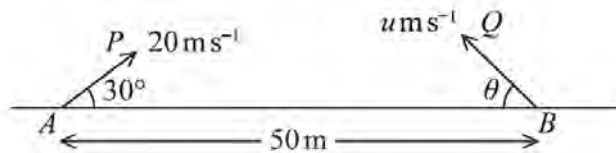


Figure 3

The points $A$ and $B$ lie 50 m apart on horizontal ground.

At time $t = 0$ two small balls, $P$ and $Q$, are projected in the vertical plane containing $AB$.

Ball $P$ is projected from $A$ with speed 20 m s$^{-1}$ at 30° to $AB$.

Ball $Q$ is projected from $B$ with speed $u$ m s$^{-1}$ at angle $\theta$ to $BA$, as shown in Figure 3.

At time $t = 1$ second, $P$ and $Q$ collide.

Until they collide, the balls are modelled as particles moving freely under gravity.

($a$) Find the magnitude and the direction of the velocity of $P$ at the instant before it collides with $Q$.

**(6)**

($b$) Find

    (i)   the size of angle $\theta$,

    (ii)  the value of $u$.

**(6)**

($c$) State one limitation of the model, other than air resistance, that could affect the accuracy of your answers.

**(1)**

**(Total for Question 5 is 13 marks)**