**1** A child kicks a ball so that it leaves horizontal ground with a velocity of 28 m s$^{-1}$ at an angle of 34° to the horizontal, as shown in Fig. 1.1.

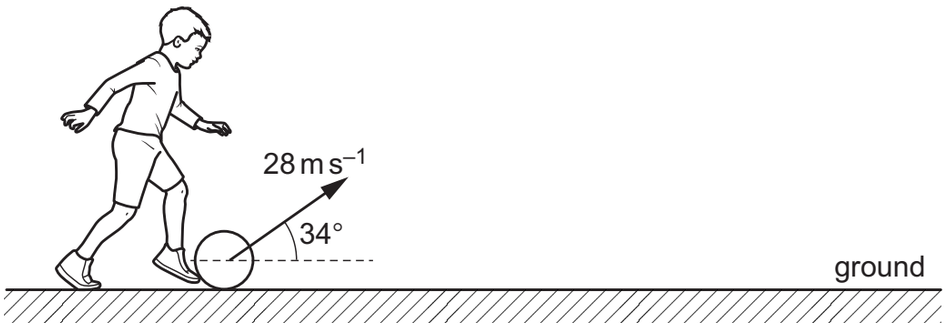


**Fig. 1.1**

Air resistance is negligible. The ball leaves the ground at time $t = 0$.

**(a) (i)** Calculate the horizontal component $v_H$ and the vertical component $v_V$ of the velocity of the ball immediately after it has left the ground.

$v_H$ = ..... m s$^{-1}$

$v_V$ = ..... m s$^{-1}$ [2]

**(ii)** Show that the ball reaches its maximum height at time $t = 1.6$ s.

[1]

**(b)** The total change in momentum of the ball between leaving the ground at $t = 0$ and landing on the ground at $t = 3.2$ s is 13 kg m s$^{-1}$.

**(i)** Define momentum.

.....

..... [1]

**(ii)** Calculate the force that acts on the ball while it is in the air.

force = ..... N [2]

**(iii)** Determine the mass of the ball.

mass = ..... kg [1]

[Total: 11]