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.

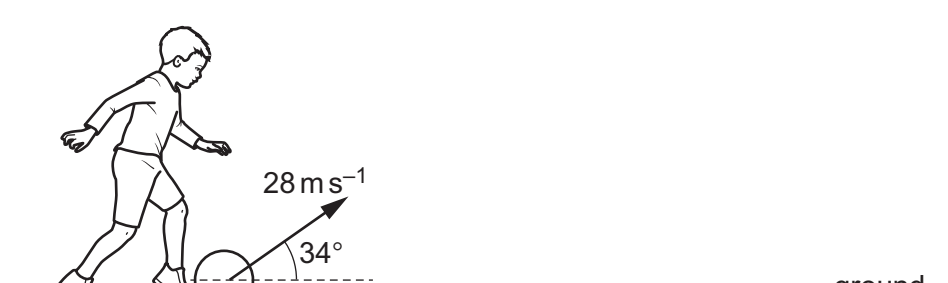

Fig. 1.1

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 $t = 1.6\,s$.

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(iii) On Fig. 1.2, sketch the variation of v_H with time t between $t = 0$ and $t = 3.2\,s$. Label your line H.

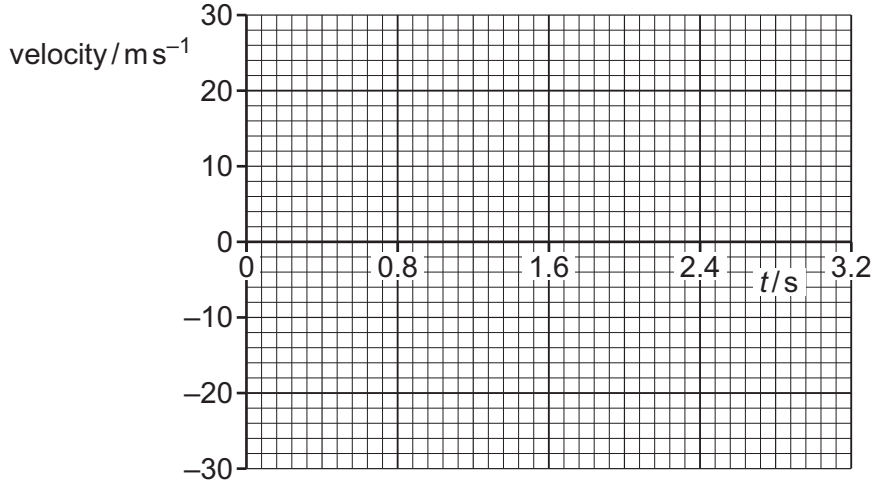

Fig. 1.2

[1]

(iv) On Fig. 1.2, sketch the variation of v_V with time t between $t = 0$ and $t = 3.2\,s$. Assume that velocity in the upward direction is positive. Label your line V. [3]

(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]