

- 2 The engine of a toy rocket pushes gases vertically downwards and this results in the rocket accelerating vertically upwards from the ground.

The rocket starts to move from rest at time $t = 0$. The variation with time t of the vertical velocity v of the rocket for the first 0.30 s of the flight is shown in Fig. 2.1.

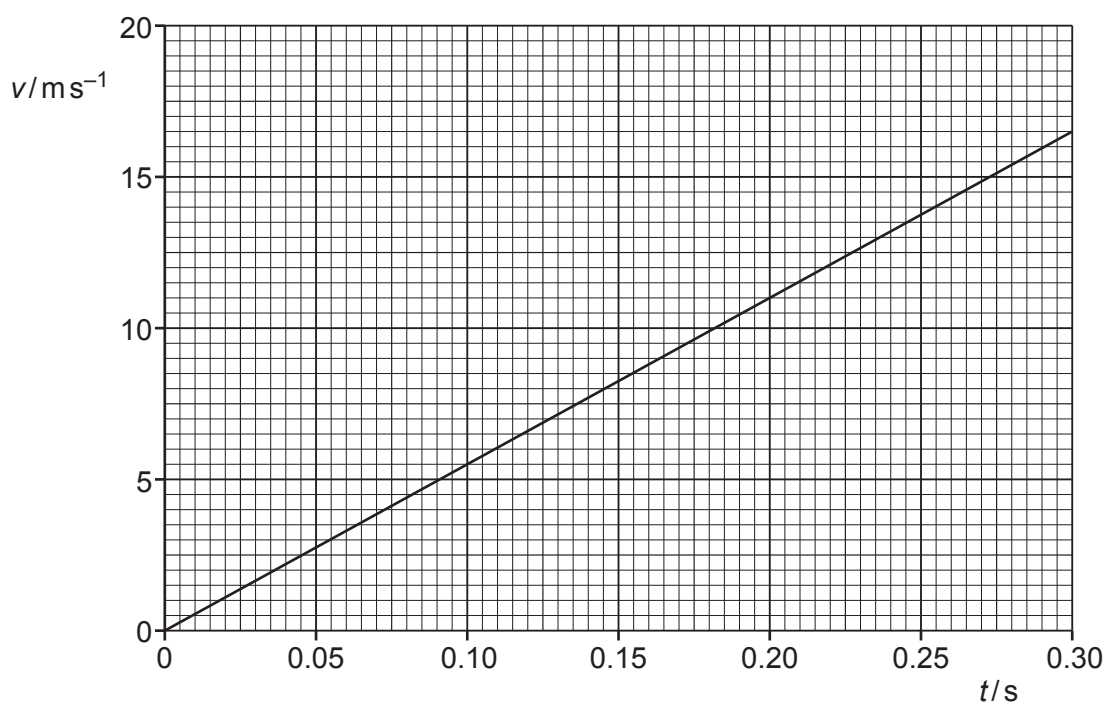


Fig. 2.1

As the rocket moves, the thrust force T provided by the rocket engine is 16 N. Assume that the mass of the rocket is constant for this part of its flight.

Assume that air resistance is negligible.

(a) For this part of the rocket's flight:

- (i) show that the acceleration of the rocket is 55 m s^{-2}

[1]

- (ii) state an expression for the resultant force F experienced by the rocket in terms of the thrust force T and the weight W of the rocket

[1]

(iii) calculate the mass of the rocket.

mass = kg [2]

(b) At time $t = 0.30$ s, a small piece of metal separates from the rocket.

Calculate:

(i) the height of the rocket above the ground at $t = 0.30$ s

height = m [2]

(ii) the speed at which the piece of metal strikes the ground.

speed = ms^{-1} [3]

[Total: 9]