

- 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.

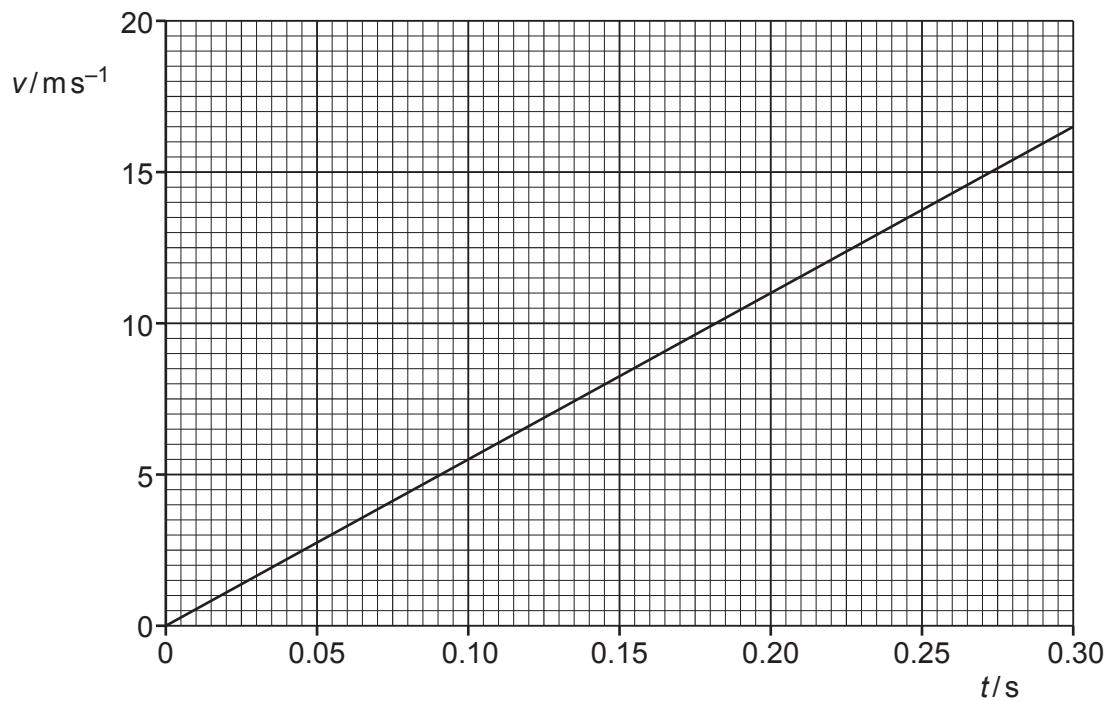


Fig. 2.1

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 ms^{-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 $t = 0.30\text{ s}$, a small piece of metal separates from the rocket.

Calculate:

- (i) the height of the rocket above the ground at $t = 0.30\text{ s}$

height = m [2]

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

speed = ms^{-1} [3]