



## Section A

Answer **all** the questions in this Section.

For  
Examiner's  
Use

- 1 A toy car with a rocket engine moves along a horizontal track, as shown in Fig. 1.1.

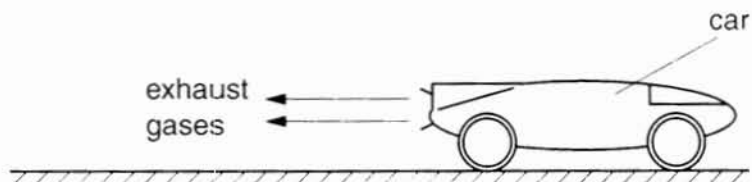


Fig. 1.1

The rocket engine produces a constant forward force of 4.6 N. The car loses mass continuously as exhaust gases are produced by the rocket.

- (a) Use momentum considerations to explain why the rocket produces a forward force on the car.

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.....[3]

- (b) The variation with time  $t$  of the speed  $v$  of the car is shown in Fig. 1.2.

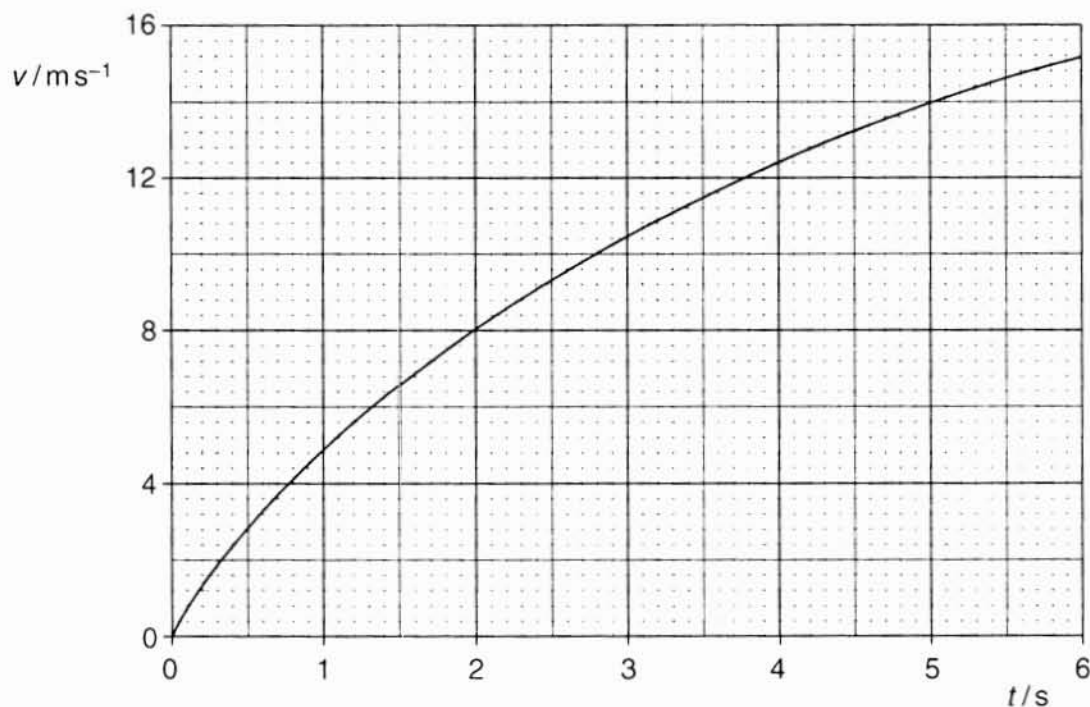


Fig. 1.2



At time  $t = 2.0$  s, the mass of the car is 440 g.

(i) For the time  $t = 2.0$  s,

1. use Fig. 1.2 to determine the acceleration of the car,

acceleration = .....  $\text{ms}^{-2}$  [2]

2. use your answer in (i) **part 1** to determine the magnitude of the resistive force acting on the car.

force = ..... N [2]

- (ii) Explain how it can be deduced that the resistive forces acting on the car increase with increase of speed.

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 .....  
 ..... [2]

- (c) The toy car is now re-fuelled and then rotated so that it is pointing upwards.

It is suggested that the rocket engine produces sufficient force to propel the car vertically.

By considering the acceleration of the car at time  $t = 0$  in Fig. 1.2, comment on this suggestion.

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 .....  
 .....  
 ..... [3]