1 **(a)** **(i)** Define momentum.

.... [1]

(ii) A car is travelling at close to the top speed on an expressway. It is then brought to rest.

Estimate the impulse of the car.

impulse = ……………………....... …………... [3]

(b) An aeroplane is at rest on a runway. It accelerates in a straight line along the runway and after 55.0 s it takes off. While the aeroplane is in contact with the runway, the resultant force on it varies. Fig. 1.1 is a graph that shows how the resultant force varies with time.
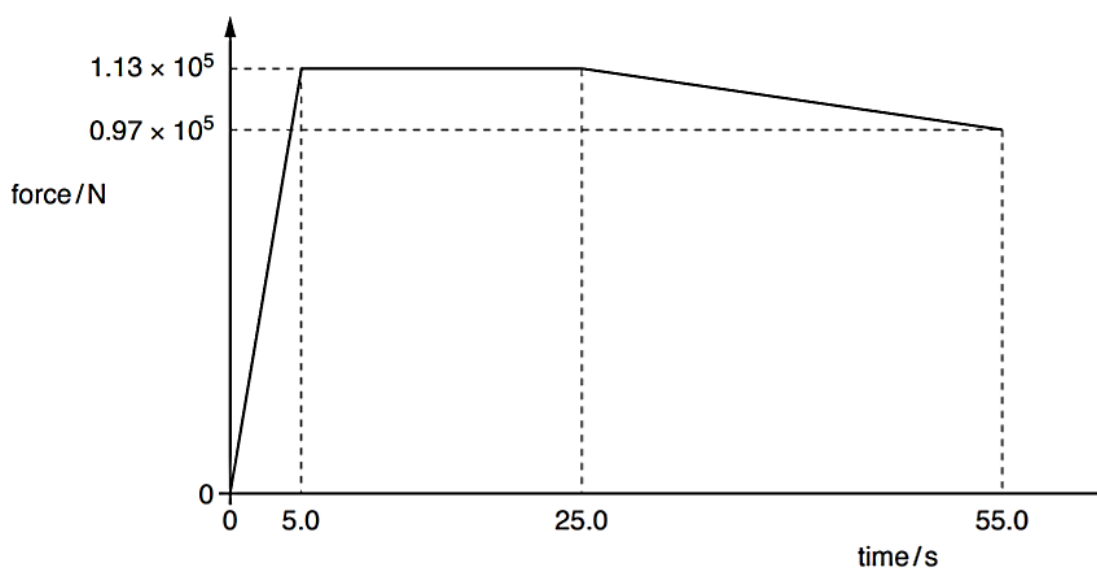

Fig. 1.1

(i) State two reasons why the acceleration of the aeroplane is not constant as it travels along the runway.

1. ....

....

2. ....

.... [2]

(ii) The total mass of the aeroplane is 7.31×10^4 kg. Calculate the velocity v_{max} of the aeroplane at take-off.

$v_{max} =$ ………………………………… m s^{-1} [4]

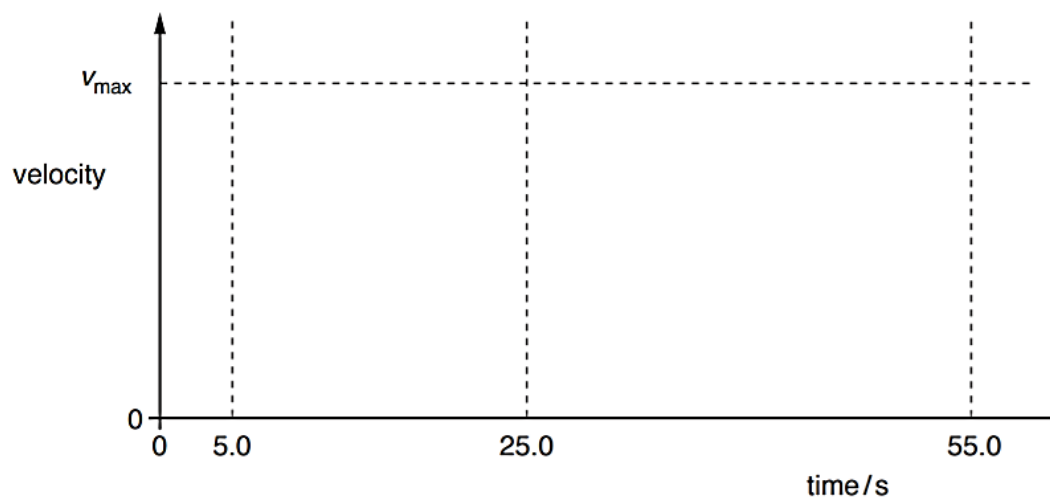**(iii)** On Fig. 1.2, sketch the shape of the velocity-time graph for the aeroplane as it travels along the runway.

Fig. 1.2

[3]

(iv) Estimate the distance the aeroplane travels along the runway.

distance = ………………………………. m [2]