

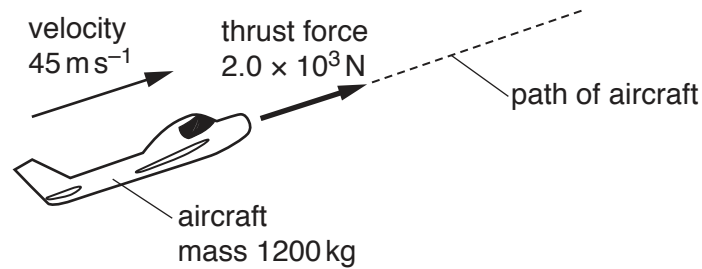
- 3 (a) (i) Define *power*.

.....  
 ..... [1]

- (ii) State what is meant by *gravitational potential energy*.

.....  
 ..... [1]

- (b) An aircraft of mass  $1200\text{ kg}$  climbs upwards with a constant velocity of  $45\text{ m s}^{-1}$ , as shown in Fig. 3.1.



**Fig. 3.1** (not to scale)

The aircraft's engine produces a thrust force of  $2.0 \times 10^3\text{ N}$  to move the aircraft through the air. The rate of increase in height of the aircraft is  $3.3\text{ m s}^{-1}$ .

- (i) Calculate the power produced by the thrust force.

power = ..... W [2]

(ii) Determine, for a time interval of 3.0 minutes,

1. the work done by the thrust force to move the aircraft,

work done = ..... J [2]

2. the increase in gravitational potential energy of the aircraft,

increase in gravitational potential energy = ..... J [2]

3. the work done against air resistance.

work done = ..... J [1]

(iii) Use your answer in (b)(ii) part 3 to calculate the force due to air resistance acting on the aircraft.

force = ..... N [1]

(iv) With reference to the motion of the aircraft, state and explain whether the aircraft is in equilibrium.

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

[Total: 12]

**[Turn over]**