1 **(a)** Define

(i) *displacement*,

.....

..... [1]

(ii) *acceleration*.

.....

..... [1]

(b) A remote-controlled toy car moves up a ramp and travels across a gap to land on another ramp, as illustrated in Fig. 1.1.

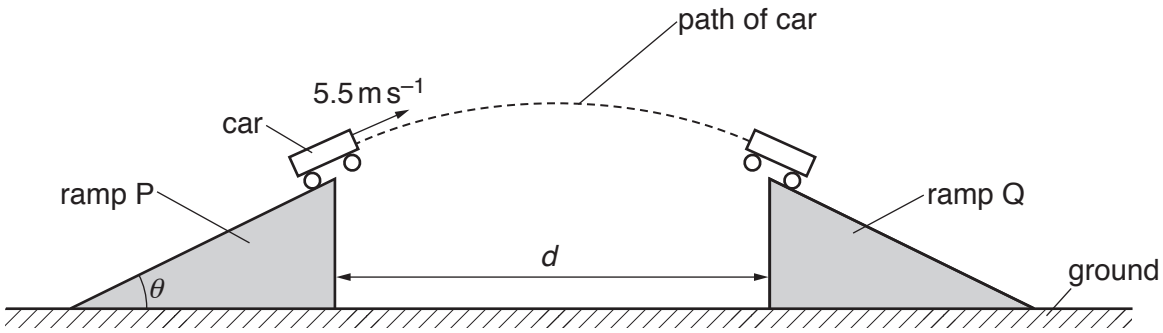

Fig. 1.1

The car leaves ramp P with a velocity of 5.5 m s^{-1} at an angle θ to the horizontal. The horizontal component of the car's velocity as it leaves the ramp is 4.6 m s^{-1}. The car lands at the top of ramp Q. The tops of both ramps are at the same height and are distance *d* apart. Air resistance is negligible.

(i) Show that the car leaves ramp P with a vertical component of velocity of 3.0 m s^{-1}.

[1]

(ii) Determine the time taken for the car to travel between the ramps.

time taken = ... s [2]

(iii) Calculate the horizontal distance d between the tops of the ramps.

d = ... m [1]

(iv) Calculate the ratio

$$\frac{\text{kinetic energy of the car at its maximum height}}{\text{kinetic energy of the car as it leaves ramp P}}.$$

ratio = ... [3]

(c) Ramp Q is removed. The car again leaves ramp P as in **(b)** and now lands directly on the ground. The car leaves ramp P at time $t = 0$ and lands on the ground at time $t = T$.

On Fig. 1.2, sketch the variation with time t of the vertical component v_y of the car's velocity from $t = 0$ to $t = T$. Numerical values of v_y and t are not required.

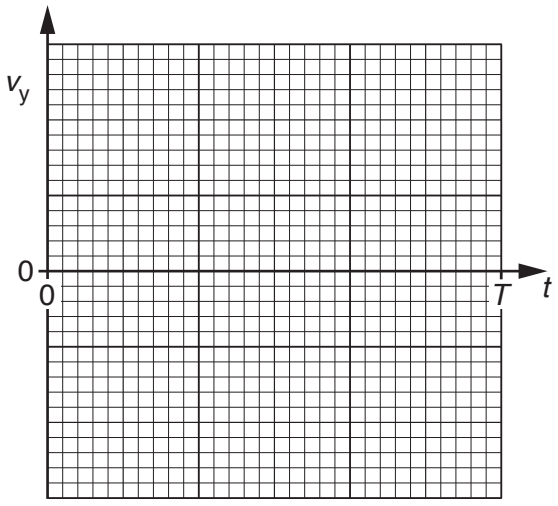

Fig. 1.2

[2]

[Total: 11]