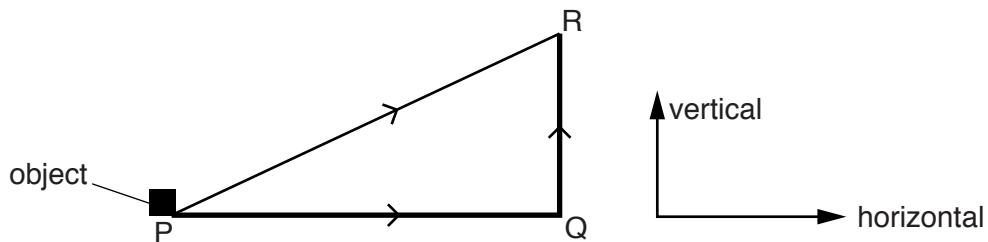


- 3 (a) An object is moved from point P to point R either by a direct path or by the path P to Q to R, as shown in Fig. 3.1.



**Fig. 3.1**

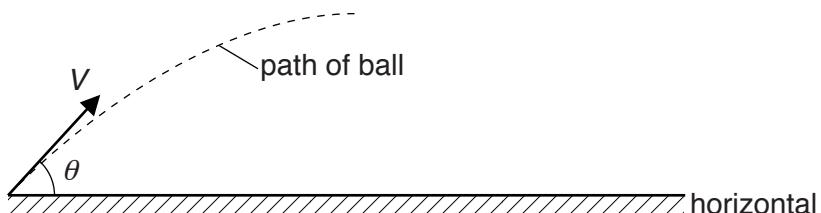
P and Q are on the same horizontal level. R is vertically above Q.

Explain whether the work done moving the object against the gravitational field is the same or different along paths PR and PQR.

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.....  
.....

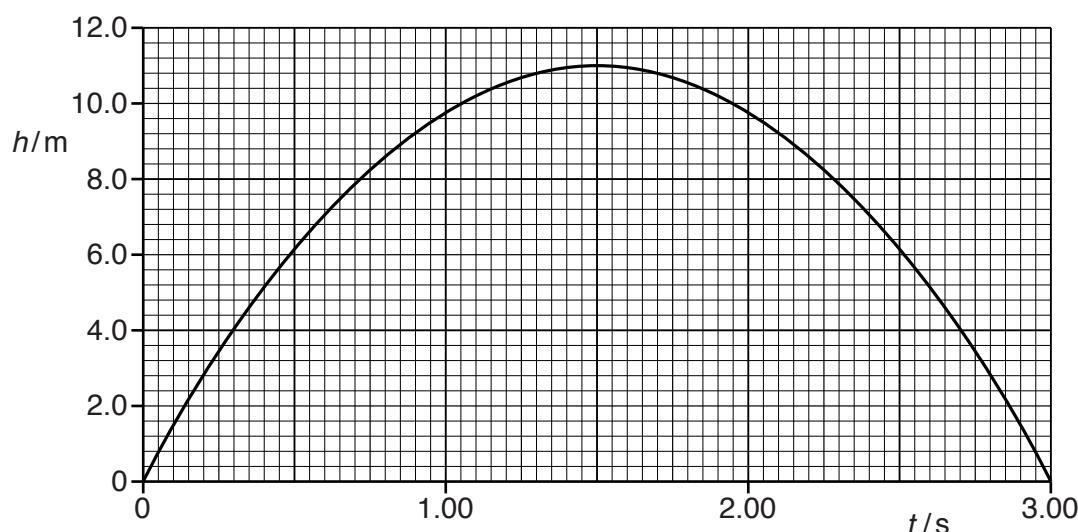
[2]

- (b) A ball is thrown with an initial velocity  $V$  at an angle  $\theta$  to the horizontal, as shown in Fig. 3.2.



**Fig. 3.2** (not to scale)

The variation with time  $t$  of the height  $h$  of the ball is shown in Fig. 3.3.



**Fig. 3.3**

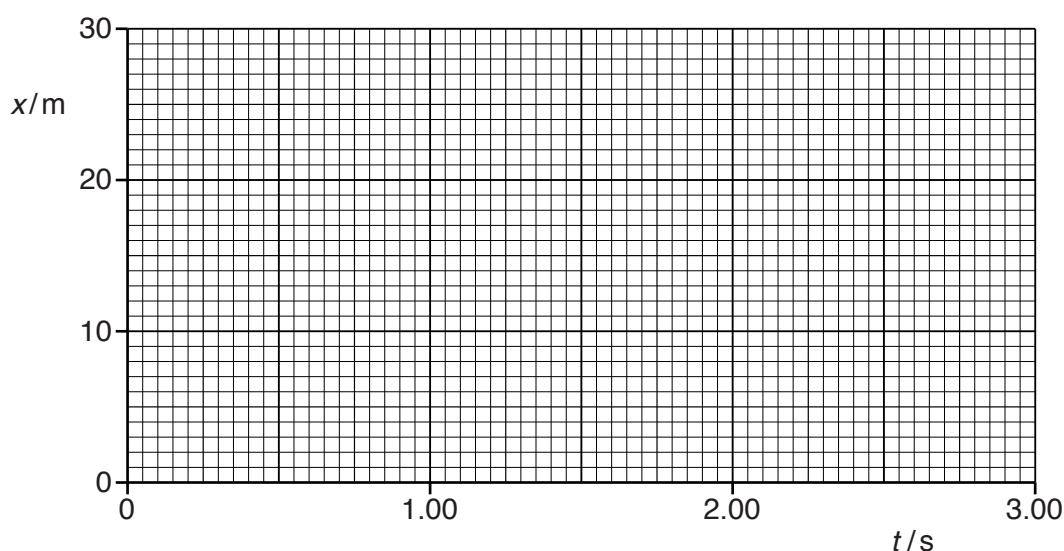
Air resistance is negligible.

- (i) Use the time to reach maximum height to determine the vertical component  $V_v$  of the velocity of the ball for time  $t = 0$ .

$$V_v = \dots \text{ ms}^{-1} [2]$$

- (ii) The horizontal displacement of the ball at  $t = 3.00\text{ s}$  is  $25.5\text{ m}$ .

On Fig. 3.4, draw the variation with  $t$  of the horizontal displacement  $x$  of the ball.



**Fig. 3.4**

[1]

- (iii) For the ball at maximum height, calculate the ratio

$$\frac{\text{potential energy of the ball}}{\text{kinetic energy of the ball}}.$$

$$\text{ratio} = \dots [3]$$

- (iv) In practice, air resistance is not negligible. State and explain the effect of air resistance on the time taken for the ball to reach maximum height.

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[2]