1

(a)

A projectile, at ground level, is launched with an initial velocity *u* at an angle θ to the horizontal as shown in Fig. 1.1.

Fig. 1.1

Ignoring the effects of air resistance, show that the time t_0 taken by the projectile to land on the ground is given by

$$t_0 = \frac{2u\sin\theta}{g}.$$

Explain your working.

[2]

(b)

Fig. 1.2 shows a cart moving with constant velocity v in front of the projectile launcher.

A projectile is launched with velocity $u = 35$ m s^{-1} at an angle $\theta = 23°$. At this instant, the back of the cart is 45 m from the position of launch.

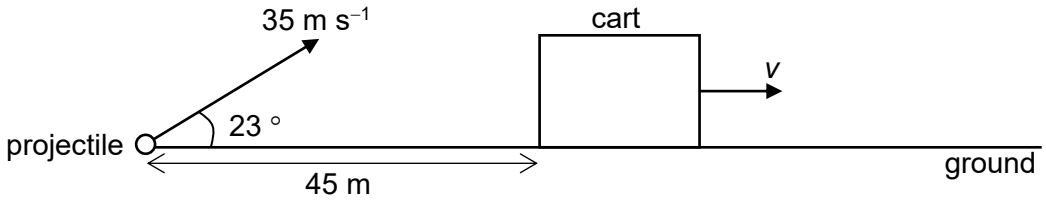

Fig. 1.2

(i)

Ignoring the effects of air resistance,

1.

Determine the velocity v of the cart such that the projectile will land just behind it.

v =

m s^{-1}

[3]

2.

On Fig. 1.3, sketch the variation with time t of the kinetic energy E_K of the projectile from the time it was launched to the time it just lands behind the cart. Include all relevant numerical values on the horizontal axis.


E_K
0
t / s

Fig. 1.3

[2]

(ii)

Suggest how the projectile should be launched such that it will still land just behind the cart, if the effects of air resistance on the projectile are not negligible.

[1]