Question 1 [4 marks]

A soft-drink bottle of mass 0.5kg is set on the ground, pointing **vertically** down, as shown in **Figure 1**. When a Mentos is placed in the bottle, for a period of 1.5 seconds, the bottle is propelled upwards with a constant force of $22N$. Assume that the mass of the Mentos is negligible and ignore the effects of air resistance.

Figure 1

a. What is the magnitude of the net force acting on the soft-drink bottle.

2 marks

SAMPLE

b. After 1.5 seconds, what is the height of the soft-drink bottle above the ground. Express your answer to three significant figures.

2 marks

SAMPLE

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Figure 1

a. What is the magnitude of the net force acting on the soft-drink bottle.

2 marks

Solution:

The diagram on the right shows the direction and the relative magnitudes of the forces acting on the soft-drink bottle.

$F_P = 22N$, given in the stimulus material.

$F_g = mg$

$F_g = 0.5 \times 9.81 = 4.91N$

$F_{net} = F_P - F_g$

$F_{net} = 22 - 4.91 = 17.1N$

SAMPLE

b. After 1.5 seconds, what is the height of the soft-drink bottle above the ground. Express your answer to three significant figures.

2 marks

Solution:

Find the acceleration of the soft-drink bottle.

$a = \frac{17.1}{0.5} = 34.2\text{ms}^{-2}$

Use our **SUVAT** equation: $s = ut + \frac{1}{2}at^2$

$h = 0 \times 1.5 + \frac{1}{2} \times 34.2 \times (1.5)^2$

$h = 17.1(1.5)^2$

$h = 38.475$ metres.

Therefore, height = 38.5 metres, to three significant figures.

SAMPLE