PQ 6b

SUVAT

Questions and Answers

Q1

A car travelling at $20ms^{-1}$ accelerates at $1{\cdot}5ms^{-2}$ until it is travelling at $50ms^{-1}$. What distance does it travel while doing this?

$u = 20 \quad v = 50 \quad a = 1.5 \quad s = ?$

$$v^2 = u^2 + 2as$$

$$s = (v^2 - u^2) \div 2a$$

$$= (2500 - 400) \div 3$$

$$= 700m$$

Q2

A ball is dropped off the top of a building and takes 3s to reach the ground. How high is the building?

$a = -9.8\ ms^{-2}$ $t = 3s$ $u = 0$

$s = ut + \frac{1}{2}at^2$

$= \frac{1}{2} \times -9.8 \times 9$

$= -44.1m$ (measured from the top....the building is 44.1m tall)

Q3

A gun with a barrel of length 0·8m is fired and the bullet leaves the barrel at $500ms^{-1}$. What was the acceleration of the bullet as it travelled along the barrel?

$a = ?$ $s = 0.8$ $u = 0$ $v = 500$

$v^2 = u^2 + 2as$

$a = (v^2 - u^2) \div 2s$

$a = 156250ms^{-2}$

Q4

A rocket in space is travelling at $100ms^{-1}$ when it starts to slow down at $2ms^{-2}$ until it is travelling at $50ms^{-1}$. How far does it travel while doing this?

$u = 100$ $a = -2$ $v = 50$ $s = ?$

$v^2 = u^2 + 2as$

$s = (v^2 - u^2) \div 2a$

$= 1875m$

Q5

A car travelling at $20ms^{-1}$ accelerates at $1{\cdot}5ms^{-2}$ until it is travelling at $50ms^{-1}$. What distance does it travel while doing this?

$u = 20 \quad v = 50 \quad a = 1.5 \quad s = ?$

$$v^2 = u^2 + 2as$$

$$s = (v^2 - u^2) \div 2a$$

$$= (2500 - 400) \div 3$$

$$= 700m$$

Q6

A ball is dropped off the top of a building and takes 3s to reach the ground. How high is the building?

$a = -9.8\ ms^{-2}$ $t = 3s$ $u = 0$

$s = ut + \frac{1}{2} at^2$

$= \frac{1}{2} \times -9.8 \times 9$

$= -44.1m$ (measured from the top....the building is 44.1m tall)

Q7

A gun with a barrel of length 0·8m is fired and the bullet leaves the barrel at 500ms^{-1}. What was the acceleration of the bullet as it travelled along the barrel?

$a = ?$ $\quad s = 0.8$ $\quad u = 0$ $\quad v = 500$

$v^2 = u^2 + 2as$

$a = (v^2 - u^2) \div 2s$

$a = 156250 ms^{-2}$

Q8

A rocket in space is travelling at $100ms^{-1}$ when it starts to slow down at $2ms^{-2}$ until it is travelling at $50ms^{-1}$. How far does it travel while doing this?

$u = 100$ $a = -2$ $v = 50$ $s = ?$

$v^2 = u^2 + 2as$

$s = (v^2 - u^2) \div 2a$

$= 1875m$

Q9

A workman on the scaffolding outside one of the science classrooms drops a wrench. A physics student, bored with the lesson, times it as it falls past the classroom window. She found that it took 0.6s to fall past the 2m tall window. Calculate the spanner's **initial** velocity as it appears at the top of the window.

$s = -2$ $t = 0.6$ $a = -9.8$ $u = ?$

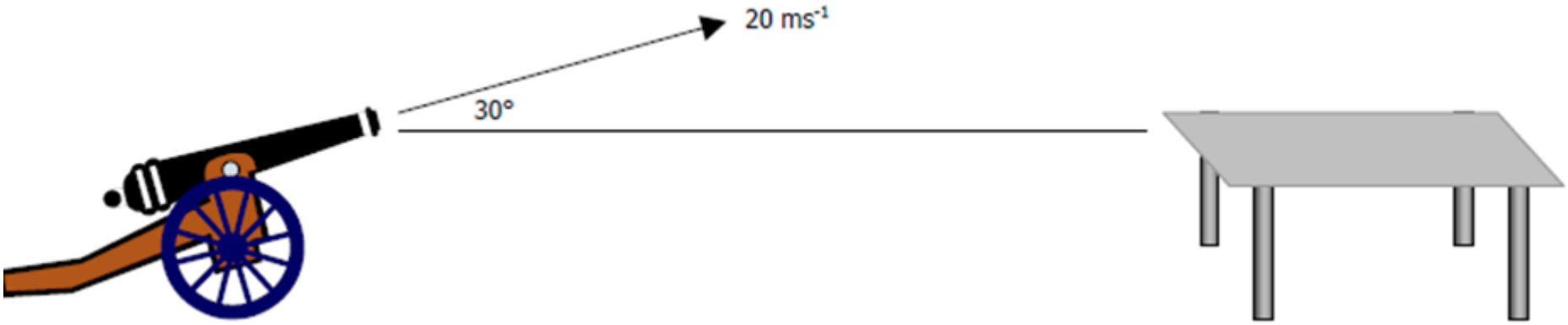
$$s = ut + \tfrac{1}{2}at^2$$

$$u = (s - \tfrac{1}{2}at^2) \div t$$

$$= -0.39 ms^{-1} \text{ (falling down)}$$

Q10

A human cannonball at a circus is fired from the cannon with a muzzle velocity of 20 ms^{-1} at 30° to the ground, and (hopefully) lands in a safety net that is at the same height as the mouth of the cannon.



(a) Calculate the horizontal and vertical components of the performer's velocity.

(b) How high above the net was he at his highest point?

(c) How far from the cannon should the net have been placed to safely catch the performer?

(d) In practice, this distance would have to be slightly shorter. Why?

Q10 continued

a/ horizontal velocity = 20cos30 = $17.32 ms^{-1}$ vertical velocity = 20sin30 = $10 ms^{-1}$

b/ The highest point is reached when the final speed = 0

u = 10 a = -9.8 v = 0 s = ?

$v^2 = u^2 + 2as$ rearrange to get $s = (v^2 - u^2) \div 2a$

= 5.1m

c/ time in air needs to be calculated. First of all calculate the time it takes to reach the highest point, then double it.

a = -9.8 v = 0 u = 10 t = ?

$v = u + at$

$t = (v - u) \div a$

= 1.02s total time in air = 2.04s

the distance the net should be is just (horizontal speed) x (time in air)

place net 35.33m away