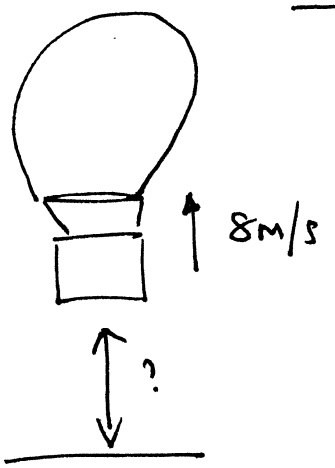
Equations of Motion 2

(1)



3 parts to balls movement,

- upwards part with initial velocity of +8 m/s but slowed by 9 until ø
- return part of parabola.
- Accelerated by 9.

taking up as positive

$s = ?$
$u = +8\ m/s$
$v = x$
$a = -98$
$t = 15s$

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

$s = +8 \times 15 + \frac{1}{2} -9.8 \times (15)^2$

$= 120 - 1102.5$

$= 982.5\ m$

(2) calculate distance travelled by light in 4.5 years

using $speed = \frac{distance}{time}$ for distance

$distance = Speed \times time$

$distance = 3 \times 10^8 \times 4.5 \times 365 \times 24 \times 60 \times 60$

$= 4.257 \times 10^{16}\ m$

Journey is in two parts:-

Part under acceleration +

Part at constant speed.

acceleration part 7 days from rest at 30 m/s².

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

$$s = 0 + \frac{1}{2} \times 30 \times (7 \times 24 \times 60 \times 60)^2$$

$$s = \underline{5.4867 \times 10^{12} \text{ m}}$$

Find final speed after 7 days acceleration at 30 m/s

using $v = u + at$

$$v = 0 + 30 \times 7 \times 24 \times 60 \times 60$$

$$\underline{v = 1.8144 \times 10^{7} \text{ m/s}}$$

Distance left to travel at this speed = total − acc part

$$4.257 \times 10^{16} - 5.4867 \times 10^{12}$$

$$= 4.257 \times 10^{16}$$

using speed = distance / time for time

$$\text{time} = \frac{\text{distance}}{\text{speed}}$$

$$\text{time} = \frac{4.257 \times 10^{16}}{1.8144 \times 10^{7}}$$

$$\text{time} = 2.35 \times 10^{9} \text{ s}$$

$$= 2.716 \times 10^{4} \text{ days}$$

add in 7 days of accelerat

$$= \underline{\underline{7.44 \text{ years}}}$$