

4. A liquid is kept in a barrel. At the start of the year 2010, 160 litres of liquid is poured into the barrel. If 15% of the volume of the liquid is lost by evaporation during the year,



- (i) evaluate the amount of liquid in the barrel at the end of the year
- (ii) show that the amount of liquid in the barrel at the end of 2020 is approximately 31.5 litres.

At the start of each year, starting in 2010, a new barrel is filled with 160 litres of liquid. This process is continued for twenty years until 2030.

- (iii) Calculate the total amount of liquid in the barrels after evaporation at the end of the year 2030.

(i)

| Date | Volume |
|------------|--------------------------|
| 1 Jan 2010 | 160 litres |
| 1 Jan 2011 | $160(0.85) = 136$ litres |

If 15% is lost
 \Rightarrow 85% is left

(ii) This is a geometric sequence

$T_n = ar^{n-1}$

$a = 160, r = 0.85$
 $n = ?$ end of 2020 = 1 Jan 2021
 $\Rightarrow n = 2021 - 2010 = 11$

$T_{11} = 160(0.85)^{10} \approx 31$ litres

At the start of each year, starting in 2010, a new barrel is filled with 160 litres of liquid. This process is continued for twenty years until 2030.

- (iii) Calculate the total amount of liquid in the barrels after evaporation at the end of the year 2030.

$a = 160$

$r = 0.85$

$n = 20$

$S_n = \frac{a(1+r^n)}{1-r}$

$S_{20} = \frac{160(1+0.85^{20})}{1-0.85}$

≈ 1108 litres