

Peter's Problem 2015

A family of two adults and three children have their water supplied by a private water scheme. They wish to minimise the cost of water in their home by harvesting rain water from the flat roof on the shed at the back of the house.

The shed measures 8 metres by 8 metres, and they believe that the amount of rainfall on the shed would best be measured as the average of the last three year's (i.e. 2012, 2013 and 2014) rainfall at Mullingar as per the Met Eireann web site.

They can use all of the water that is harvested, although they acknowledge that at most 3% of the water is lost through leakage and condensation and a further 2% is used to wash their car and water the garden annually.

The family monitor their usage of water as follows:

Kitchen

Dishwasher is used 5 times a week, using 10 litres each time.

Washing machine is used 6 times weekly using 46 litres each time

The water tap in the kitchen sink dispenses 7 litres of water per minute and is run daily for a total of 33 minutes.

Bathroom

The cistern has a full flush using 15 litres and a mini flush using 6 litres. The full flush is used on average 8 times a day and the mini flush 28 times daily.

The bath is run 3 times weekly using 120 litres of water each time.

The shower is used 45 times a week. Each shower lasts an average of 3mins and 45 seconds, and the shower dispenses water at a rate of 9 litres per minute.

The hand basin taps in the bathroom flow at the rate of 5 litres per minute and are run every day for a total of 28 minutes.

1. Using the above information, calculate the number of litres of water required by the family annually from the water scheme for household use.

For the purposes of the problem, there are 365 days and 52 weeks in the year.

The charges from the water scheme are as follows:

Annual standing charge: €50

Annual allowance: 30000 litres plus 10000 litres per person per household

Additional water usage is charged as follows:

.05 cent per litre for the first 80000 litres

.09 cent per litre for the next 50000 litres

.14 cent per litre for the next 80000 litres

.42 cent per litre for the next 60000 litres

.65 cent per litre for all other usage.

2. Calculate the amount of the savings made by harvesting the water. NOTE: There is no water from the water scheme used in the garden or for car washing.
3. If a leak in the system caused the annual bill to become €353.68, how many litres of water were lost through leakage?
4. If the water bill came to €240, calculate the actual rainfall for the year?

You may enhance your solution with charts and/or illustrations as you deem appropriate.