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Time Required to Empty a Reservoir with Rectangular Weir Formulas

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List of 19 Time Required to Empty a Reservoir with Rectangular Weir Formulas

Time Required to Empty a Reservoir with Rectangular Weir

1) Bazins Constant given Time Required to Lower Liquid Surface

Open Calculator

fx $$m = \left(\frac{2 \cdot A_R}{\Delta t \cdot \sqrt{2 \cdot g}}\right) \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}}\right)$$

ex $$0.602075 = \left(\frac{2 \cdot 13m^2}{1.25s \cdot \sqrt{2 \cdot 9.8m/s^2}}\right) \cdot \left(\frac{1}{\sqrt{5.1m}} - \frac{1}{\sqrt{10.1m}}\right)$$

2) Coefficient of Discharge for Time Required to Lower Liquid Surface

Open Calculator

fx $$C_d = \left(\frac{2 \cdot A_R}{\left(\frac{2}{3}\right) \cdot \Delta t \cdot \sqrt{2 \cdot g} \cdot L_w}\right) \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}}\right)$$

ex $$0.301038 = \left(\frac{2 \cdot 13m^2}{\left(\frac{2}{3}\right) \cdot 1.25s \cdot \sqrt{2 \cdot 9.8m/s^2} \cdot 3m}\right) \cdot \left(\frac{1}{\sqrt{5.1m}} - \frac{1}{\sqrt{10.1m}}\right)$$

3) Coefficient of Discharge given Time required to Lower Liquid for Triangular Notch

fx

Open Calculator

$$C_d = \left(\frac{\left(\frac{2}{3}\right) \cdot A_R}{\left(\frac{8}{15}\right) \cdot \Delta t \cdot \sqrt{2 \cdot g} \cdot \tan\left(\frac{\theta}{2}\right)}\right) \cdot \left(\left(\frac{1}{h_2^{\frac{3}{2}}}\right) - \left(\frac{1}{H_{Upstream}^{\frac{3}{2}}}\right)\right)$$

ex

$$0.610084 = \left(\frac{\left(\frac{2}{3}\right) \cdot 13m^2}{\left(\frac{8}{15}\right) \cdot 1.25s \cdot \sqrt{2 \cdot 9.8m/s^2} \cdot \tan\left(\frac{30^\circ}{2}\right)}\right) \cdot \left(\left(\frac{1}{(5.1m)^{\frac{3}{2}}}\right) - \left(\frac{1}{(10.1m)^{\frac{3}{2}}}\right)\right)$$

4) Cross Sectional Area given Time required to Lower Liquid for Triangular Notch

Open Calculator

fx $$A_R = \frac{\Delta t \cdot \left(\frac{8}{15}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot \tan\left(\frac{\theta}{2}\right)}{\left(\frac{2}{3}\right) \cdot \left(\left(\frac{1}{h_2^{\frac{3}{2}}}\right) - \left(\frac{1}{H_{Upstream}^{\frac{3}{2}}}\right)\right)}$$

ex $$14.06364\text{m}^2 = \frac{1.25\text{s} \cdot \left(\frac{8}{15}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot \tan\left(\frac{30^\circ}{2}\right)}{\left(\frac{2}{3}\right) \cdot \left(\left(\frac{1}{(5.1\text{m})^{\frac{3}{2}}}\right) - \left(\frac{1}{(10.1\text{m})^{\frac{3}{2}}}\right)\right)}$$

5) Cross Sectional Area given Time required to Lower Liquid Surface

Open Calculator

fx $$A_R = \frac{\Delta t \cdot \left(\frac{2}{3}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot L_w}{2 \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}}\right)}$$

ex $$28.50143\text{m}^2 = \frac{1.25\text{s} \cdot \left(\frac{2}{3}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot 3\text{m}}{2 \cdot \left(\frac{1}{\sqrt{5.1\text{m}}} - \frac{1}{\sqrt{10.1\text{m}}}\right)}$$

6) Cross Sectional Area given time required to Lower Liquid Surface using Bazins Formula

Open Calculator

fx $$A_R = \frac{\Delta t \cdot m \cdot \sqrt{2 \cdot g}}{\left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}}\right) \cdot 2}$$

ex $$8.787939\text{m}^2 = \frac{1.25\text{s} \cdot 0.407 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2}}{\left(\frac{1}{\sqrt{5.1\text{m}}} - \frac{1}{\sqrt{10.1\text{m}}}\right) \cdot 2}$$

7) Head given Time Required to Lower Liquid Surface using Francis Formula

Open Calculator

fx $$H_{Avg} = \frac{\left(\frac{2 \cdot A_R}{1.84 \cdot t_F}\right) \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}}\right) - L_w}{-0.1 \cdot n}$$

ex $$6.888243\text{m} = \frac{\left(\frac{2 \cdot 13\text{m}^2}{1.84 \cdot 7.4\text{s}}\right) \cdot \left(\frac{1}{\sqrt{5.1\text{m}}} - \frac{1}{\sqrt{10.1\text{m}}}\right) - 3\text{m}}{-0.1 \cdot 4}$$

8) Head1 given Time Required to Lower Liquid for Triangular Notch

Open Calculator

fx $$H_{Upstream} = \left(\frac{1}{\left(\frac{1}{h_2^{\frac{3}{2}}}\right) - \left(\frac{\Delta t \cdot \left(\frac{8}{15}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot \tan\left(\frac{\theta}{2}\right)}{\left(\frac{2}{3}\right) \cdot A_R}\right)}\right)^{\frac{2}{3}}$$

ex $$11.22239\text{m} = \left(\frac{1}{\left(\frac{1}{(5.1\text{m})^{\frac{3}{2}}}\right) - \left(\frac{1.25\text{s} \cdot \left(\frac{8}{15}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot \tan\left(\frac{30^\circ}{2}\right)}{\left(\frac{2}{3}\right) \cdot 13\text{m}^2}\right)}\right)^{\frac{2}{3}}$$

9) Head1 given Time Required to Lower Liquid Surface

Open Calculator

fx $$H_{Upstream} = \left(\left(\frac{1}{\left(\frac{1}{\sqrt{h_2}}\right) - \frac{\Delta t \cdot \left(\frac{2}{3}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot L_w}{2 \cdot A_R}}\right)^2\right)$$

ex $$38.17403\text{m} = \left(\left(\frac{1}{\left(\frac{1}{\sqrt{5.1\text{m}}}\right) - \frac{1.25\text{s} \cdot \left(\frac{2}{3}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot 3\text{m}}{2 \cdot 13\text{m}^2}}\right)^2\right)$$

10) Head1 given Time Required to Lower Liquid Surface using Bazins Formula

Open Calculator

fx $$H_{Upstream} = \left(\left(\frac{1}{\frac{\Delta t \cdot m \cdot \sqrt{2 \cdot g}}{2 \cdot A_R} - \left(\frac{1}{\sqrt{h_2}}\right)}\right)^2\right)$$

ex $$7.882477\text{m} = \left(\left(\frac{1}{\frac{1.25\text{s} \cdot 0.407 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2}}{2 \cdot 13\text{m}^2} - \left(\frac{1}{\sqrt{5.1\text{m}}}\right)}\right)^2\right)$$

11) Head2 given Time Required to Lower Liquid for Triangular Notch

Open Calculator

fx $$h_2 = \left(\frac{1}{\left(\frac{\Delta t \cdot \left(\frac{8}{15}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot \tan\left(\frac{\theta}{2}\right)}{\left(\frac{2}{3}\right) \cdot A_R}\right) + \left(\frac{1}{H_{Upstream}^{\frac{3}{2}}}\right)}\right)^{\frac{2}{3}}$$

ex $$4.929084\text{m} = \left(\frac{1}{\left(\frac{1.25\text{s} \cdot \left(\frac{8}{15}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot \tan\left(\frac{30^\circ}{2}\right)}{\left(\frac{2}{3}\right) \cdot 13\text{m}^2}\right) + \left(\frac{1}{(10.1\text{m})^{\frac{3}{2}}}\right)}\right)^{\frac{2}{3}}$$

12) Head2 given Time Required to Lower Liquid Surface

Open Calculator

fx $$h_2 = \left(\frac{1}{\frac{\Delta t \cdot \left(\frac{2}{3}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot L_w}{2 \cdot A_R} + \left(\frac{1}{\sqrt{H_{Upstream}}}\right)}\right)^2$$

ex $$2.818833\text{m} = \left(\frac{1}{\frac{1.25\text{s} \cdot \left(\frac{2}{3}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot 3\text{m}}{2 \cdot 13\text{m}^2} + \left(\frac{1}{\sqrt{10.1\text{m}}}\right)}\right)^2$$

13) Head2 given Time Required to Lower Liquid Surface using Bazins Formula

Open Calculator

fx $$h_2 = \left(\frac{1}{\frac{\Delta t \cdot m \cdot \sqrt{2 \cdot g}}{2 \cdot A_R} + \left(\frac{1}{\sqrt{H_{Upstream}}} \right)} \right)^2$$

ex $$6.209988\text{m} = \left(\frac{1}{\frac{1.25\text{s} \cdot 0.407 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2}}{2 \cdot 13\text{m}^2} + \left(\frac{1}{\sqrt{10.1\text{m}}} \right)} \right)^2$$

14) Length of Crest for time required to Lower Liquid Surface

Open Calculator

fx $$L_w = \left(\frac{2 \cdot A_R}{\left(\frac{2}{3}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot \Delta t} \right) \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}} \right)$$

ex $$1.368353\text{m} = \left(\frac{2 \cdot 13\text{m}^2}{\left(\frac{2}{3}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot 1.25\text{s}} \right) \cdot \left(\frac{1}{\sqrt{5.1\text{m}}} - \frac{1}{\sqrt{10.1\text{m}}} \right)$$

15) Length of Crest given Time Required to Lower Liquid Surface using Francis Formula

fx

Open Calculator

$$L_w = \left(\left(\frac{2 \cdot A_R}{1.84 \cdot t_F} \right) \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}} \right) \right) + (0.1 \cdot n \cdot H_{Avg})$$

ex $$2.444703\text{m} = \left(\left(\frac{2 \cdot 13\text{m}^2}{1.84 \cdot 7.4\text{s}} \right) \cdot \left(\frac{1}{\sqrt{5.1\text{m}}} - \frac{1}{\sqrt{10.1\text{m}}} \right) \right) + (0.1 \cdot 4 \cdot 5.5\text{m})$$

16) Time Required to Lower Liquid Surface

Open Calculator

fx $$\Delta t = \left(\frac{2 \cdot A_R}{\left(\frac{2}{3}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot L_w} \right) \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}} \right)$$

ex $$0.570147\text{s} = \left(\frac{2 \cdot 13\text{m}^2}{\left(\frac{2}{3}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot 3\text{m}} \right) \cdot \left(\frac{1}{\sqrt{5.1\text{m}}} - \frac{1}{\sqrt{10.1\text{m}}} \right)$$

17) Time Required to Lower Liquid Surface for Triangular Notch

Open Calculator

$$\Delta t = \left(\frac{\left(\frac{2}{3}\right) \cdot A_R}{\left(\frac{8}{15}\right) \cdot C_d \cdot \sqrt{2 \cdot g} \cdot \tan\left(\frac{\theta}{2}\right)} \right) \cdot \left(\left(\frac{1}{h_2^{\frac{3}{2}}} \right) - \left(\frac{1}{H_{Upstream}^{\frac{3}{2}}} \right) \right)$$

ex

$$1.155462\text{s} = \left(\frac{\left(\frac{2}{3}\right) \cdot 13\text{m}^2}{\left(\frac{8}{15}\right) \cdot 0.66 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2} \cdot \tan\left(\frac{30^\circ}{2}\right)} \right) \cdot \left(\left(\frac{1}{(5.1\text{m})^{\frac{3}{2}}} \right) - \left(\frac{1}{(10.1\text{m})^{\frac{3}{2}}} \right) \right)$$

18) Time Required to Lower Liquid Surface using Bazins Formula

Open Calculator

$$\Delta t = \left(\frac{2 \cdot A_R}{m \cdot \sqrt{2 \cdot g}} \right) \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}} \right)$$

ex

$$1.849125\text{s} = \left(\frac{2 \cdot 13\text{m}^2}{0.407 \cdot \sqrt{2 \cdot 9.8\text{m/s}^2}} \right) \cdot \left(\frac{1}{\sqrt{5.1\text{m}}} - \frac{1}{\sqrt{10.1\text{m}}} \right)$$

19) Time Required to Lower Liquid Surface using Francis Formula

Open Calculator

$$t_F = \left(\frac{2 \cdot A_R}{1.84 \cdot (L_w - (0.1 \cdot n \cdot H_{Avg}))} \right) \cdot \left(\frac{1}{\sqrt{h_2}} - \frac{1}{\sqrt{H_{Upstream}}} \right)$$

ex

$$2.263502\text{s} = \left(\frac{2 \cdot 13\text{m}^2}{1.84 \cdot (3\text{m} - (0.1 \cdot 4 \cdot 5.5\text{m}))} \right) \cdot \left(\frac{1}{\sqrt{5.1\text{m}}} - \frac{1}{\sqrt{10.1\text{m}}} \right)$$

Variables Used

- A_R Cross-Sectional Area of Reservoir *(Square Meter)*
- C_d Coefficient of Discharge
- **g** Acceleration due to Gravity *(Meter per Square Second)*
- h_2 Head on Downstream of Weir *(Meter)*
- H_{Avg} Average Height of Downstream and Upstream *(Meter)*
- $H_{Upstream}$ Head on Upstream of Weir *(Meter)*
- L_w Length of Weir Crest *(Meter)*
- **m** Bazins Coefficient
- **n** Number of End Contraction
- t_F Time Interval for Francis *(Second)*
- Δt Time Interval *(Second)*
- θ Theta *(Degree)*

Constants, Functions, Measurements used

- Function: **sqrt**, sqrt(Number)
  A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.
- Function: **tan**, tan(Angle)
  The tangent of an angle is a trigonometric ratio of the length of the side opposite an angle to the length of the side adjacent to an angle in a right triangle.
- Measurement: **Length** in Meter (m)
  Length Unit Conversion
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Area** in Square Meter (m²)
  Area Unit Conversion
- Measurement: **Acceleration** in Meter per Square Second (m/s²)
  Acceleration Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion

Check other formula lists

- **Broad Crested Weir Formulas**
- **Flow Over a Trapizoidal and Triangular Weir or Notch Formulas**
- **Flow Over Rectangular Sharp Crested Weir or Notch Formulas**
- **Submerged Weirs Formulas**
- **Time Required to Empty a Reservoir with Rectangular Weir Formulas**

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