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Critical Flow and its Computation Formulas

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List of 20 Critical Flow and its Computation Formulas

Critical Flow and its Computation

1) Critical Depth for Parabolic Channel

$$\text{fx } h_p = \left(3.375 \cdot \frac{\left(\frac{Q}{S} \right)^2}{[g]} \right)^{\frac{1}{4}}$$

[Open Calculator !\[\]\(a870788d6ed9b8fd294b7654a8c8526b_img.jpg\)](#)

$$\text{ex } 143.2921\text{m} = \left(3.375 \cdot \frac{\left(\frac{14\text{m}^3/\text{s}}{0.0004} \right)^2}{[g]} \right)^{\frac{1}{4}}$$

2) Critical Depth for Rectangular Channel

$$\text{fx } h_r = \left(\frac{q^2}{[g]} \right)^{\frac{1}{3}}$$

[Open Calculator !\[\]\(c50c8b7b2cc2cf9ff925edec0ee94c0d_img.jpg\)](#)

$$\text{ex } 2.182934\text{m} = \left(\frac{(10.1\text{m}^2/\text{s})^2}{[g]} \right)^{\frac{1}{3}}$$



3) Critical Depth for Triangular Channel

[Open Calculator !\[\]\(4729e517bc6a7cd81c8025b9646574fb_img.jpg\)](#)

$$\text{fx } h_t = \left(2 \cdot \frac{\left(\frac{Q}{S} \right)^2}{[g]} \right)^{\frac{1}{5}}$$

$$\text{ex } 47.81114\text{m} = \left(2 \cdot \frac{\left(\frac{14\text{m}^3/\text{s}}{0.0004} \right)^2}{[g]} \right)^{\frac{1}{5}}$$

4) Critical Depth given Critical Energy for Rectangular Channel

[Open Calculator !\[\]\(e474458956c9a37fbf9586ddb60a7fa1_img.jpg\)](#)

$$\text{fx } h_r = \frac{E_r}{1.5}$$

$$\text{ex } 2.16\text{m} = \frac{3.24\text{m}}{1.5}$$

5) Critical Depth given Critical Energy for Triangular Channel

[Open Calculator !\[\]\(4fe57c3593bf1b21d272ae7ac8dfaf77_img.jpg\)](#)

$$\text{fx } h_t = \frac{E_t}{1.25}$$

$$\text{ex } 48\text{m} = \frac{60\text{m}}{1.25}$$



6) Critical Depth of Flow given Critical Energy for Parabolic Channel

$$\text{fx } h_p = \frac{E_c}{\frac{4}{3}}$$

[Open Calculator !\[\]\(e78f798d4ea5c530c9db49e7d26e6b95_img.jpg\)](#)

$$\text{ex } 142.5\text{m} = \frac{190\text{m}}{\frac{4}{3}}$$

7) Critical Energy for Parabolic Channel

$$\text{fx } E_c = \left(\frac{4}{3}\right) \cdot h_p$$

[Open Calculator !\[\]\(05be7c7a8995decd503647c99211f7c2_img.jpg\)](#)

$$\text{ex } 190.6667\text{m} = \left(\frac{4}{3}\right) \cdot 143\text{m}$$

8) Critical Energy for Rectangular Channel

$$\text{fx } E_r = 1.5 \cdot h_r$$

[Open Calculator !\[\]\(fe3aebe81acea8d45108cd2768939da7_img.jpg\)](#)

$$\text{ex } 3.27\text{m} = 1.5 \cdot 2.18\text{m}$$

9) Critical Energy for Triangular Channel

$$\text{fx } E_t = h_t \cdot 1.25$$

[Open Calculator !\[\]\(899d8b7697d64725bf017d3296cfcf1b_img.jpg\)](#)

$$\text{ex } 59.75\text{m} = 47.8\text{m} \cdot 1.25$$



10) Critical Section Factor

$$\text{fx } Z = \frac{Q}{\sqrt{[g]}}$$

[Open Calculator !\[\]\(e2376d476d06eb31946dc01a69a4403a_img.jpg\)](#)

$$\text{ex } 4.470619\text{m}^{\wedge}2.5 = \frac{14\text{m}^3/\text{s}}{\sqrt{[g]}}$$

11) Discharge given Critical Depth for Parabolic Channel

$$\text{fx } Q = \sqrt{(h_p^4) \cdot ((S)^2) \cdot 0.29629629629 \cdot [g]}$$

[Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

$$\text{ex } 13.94298\text{m}^3/\text{s} = \sqrt{((143\text{m})^4) \cdot ((0.0004)^2) \cdot 0.29629629629 \cdot [g]}$$

12) Discharge given Critical Depth for Triangular Channel

$$\text{fx } Q = \sqrt{(h_t^5) \cdot ((S)^2) \cdot 0.5 \cdot [g]}$$

[Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)

$$\text{ex } 13.99185\text{m}^3/\text{s} = \sqrt{((47.8\text{m})^5) \cdot ((0.0004)^2) \cdot 0.5 \cdot [g]}$$

13) Discharge given Critical Section Factor

$$\text{fx } Q = Z \cdot \sqrt{[g]}$$

[Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

$$\text{ex } 21.29459\text{m}^3/\text{s} = 6.8\text{m}^{\wedge}2.5 \cdot \sqrt{[g]}$$



14) Discharge per unit Width given Critical Depth for Rectangular Channel



$$\text{fx } q = \left((h_r^3) \cdot [g] \right)^{\frac{1}{2}}$$

[Open Calculator](#)

$$\text{ex } 10.07964 \text{ m}^2/\text{s} = \left(\left((2.18 \text{ m})^3 \right) \cdot [g] \right)^{\frac{1}{2}}$$

15) Side Slope of Channel given Critical Depth for Parabolic Channel



$$\text{fx } S = \left(3.375 \cdot \frac{(Q)^2}{(h_p^4) \cdot [g]} \right)^{\frac{1}{2}}$$

[Open Calculator](#)

$$\text{ex } 0.000402 = \left(3.375 \cdot \frac{(14 \text{ m}^3/\text{s})^2}{((143 \text{ m})^4) \cdot [g]} \right)^{\frac{1}{2}}$$

16) Side Slope of Channel given Critical Depth for Triangular Channel



$$\text{fx } S = \left(2 \cdot \frac{(Q)^2}{(h_t^5) \cdot [g]} \right)^{\frac{1}{2}}$$

[Open Calculator](#)

$$\text{ex } 0.0004 = \left(2 \cdot \frac{(14 \text{ m}^3/\text{s})^2}{((47.8 \text{ m})^5) \cdot [g]} \right)^{\frac{1}{2}}$$



Section Factor

17) Hydraulic Depth given Section Factor

$$\text{fx } D_{\text{Hydraulic}} = \left(\frac{Z}{A} \right)^2$$

[Open Calculator !\[\]\(83f22ed94ec5517769dd76d702c6bfd8_img.jpg\)](#)

$$\text{ex } 0.073984\text{m} = \left(\frac{6.8\text{m}^{2.5}}{25\text{m}^2} \right)^2$$

18) Section Factor in open channel

$$\text{fx } Z = 0.544331054 \cdot T \cdot (d_f^{1.5})$$

[Open Calculator !\[\]\(3cb60d42b10e53f9522bb0b392c1c4cd_img.jpg\)](#)

$$\text{ex } 6.852567\text{m}^{2.5} = 0.544331054 \cdot 2.1\text{m} \cdot ((3.3\text{m})^{1.5})$$

19) Top Width given Section Factors

$$\text{fx } T = \frac{A^3}{Z^2}$$

[Open Calculator !\[\]\(0d7ca0919e6c47bbd874bfa0189fe22e_img.jpg\)](#)

$$\text{ex } 337.9109\text{m} = \frac{(25\text{m}^2)^3}{(6.8\text{m}^{2.5})^2}$$



20) Wetted Area given Section Factor

[Open Calculator !\[\]\(3d8c13c92b853674f749aac6fa869926_img.jpg\)](#)

$$\text{fx } A = \frac{Z}{\sqrt{D_{\text{Hydraulic}}}}$$

$$\text{ex } 3.925982\text{m}^2 = \frac{6.8\text{m}^{2.5}}{\sqrt{3\text{m}}}$$



Variables Used

- **A** Wetted Surface Area of Channel (*Square Meter*)
- **d_f** Depth of Flow (*Meter*)
- **D_{Hydraulic}** Hydraulic Depth (*Meter*)
- **E_c** Critical energy of Parabolic Channel (*Meter*)
- **E_r** Critical Energy of Rectangular Channel (*Meter*)
- **E_t** Critical Energy of Triangular Channel (*Meter*)
- **h_p** Critical Depth of Parabolic Channel (*Meter*)
- **h_r** Critical Depth of Rectangular Channel (*Meter*)
- **h_t** Critical Depth of Triangular Channel (*Meter*)
- **q** Discharge per unit Width (*Square Meter per Second*)
- **Q** Discharge of Channel (*Cubic Meter per Second*)
- **S** Bed Slope
- **T** Top Width (*Meter*)
- **Z** Section Factor (*Meter^{2.5}*)



Constants, Functions, Measurements used

- **Constant:** **[g]**, 9.80665 Meter/Second²
Gravitational acceleration on Earth
- **Function:** **sqrt**, sqrt(Number)
Square root function
- **Measurement:** **Length** in Meter (m)
Length Unit Conversion 
- **Measurement:** **Area** in Square Meter (m²)
Area Unit Conversion 
- **Measurement:** **Volumetric Flow Rate** in Cubic Meter per Second (m³/s)
Volumetric Flow Rate Unit Conversion 
- **Measurement:** **Kinematic Viscosity** in Square Meter per Second (m²/s)
Kinematic Viscosity Unit Conversion 
- **Measurement:** **Section Factor** in Meter^{2.5} (m^{2.5})
Section Factor Unit Conversion 



Check other formula lists

- **Computation of Uniform Flow Formulas** 
- **Critical Flow and its Computation Formulas** 
- **Geometrical Properties of Channel Section Formulas** 
- **Metering Flumes and Momentum in Open-Channel Flow Specific Force Formulas** 
- **Specific Energy and Critical Depth Formulas** 

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