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Microscopes and Telescopes Formulas

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List of 22 Microscopes and Telescopes Formulas

Microscopes and Telescopes

Astronomical Telescope

1) Length of Astronomical Telescope

$$fx \quad L_{\text{telescope}} = f_o + \frac{D \cdot f_e}{D + f_e}$$

Open Calculator 

$$ex \quad 103.4483\text{cm} = 100\text{cm} + \frac{25\text{cm} \cdot 4\text{cm}}{25\text{cm} + 4\text{cm}}$$

2) Length of Astronomical Telescope when Image Forms at Infinity

$$fx \quad L_{\text{telescope}} = f_o + f_e$$

Open Calculator 

$$ex \quad 104\text{cm} = 100\text{cm} + 4\text{cm}$$

3) Magnifying Power of Astronomical Telescope when Image Forms at Infinity

$$fx \quad M = \frac{f_o}{f_e}$$

Open Calculator 

$$ex \quad 25 = \frac{100\text{cm}}{4\text{cm}}$$



4) Magnifying Power of Astronomical Telescope when Image Forms at Least Distance of Distinct Vision

$$\text{fx } M = \left(1 + \frac{f_e}{D}\right) \cdot \frac{f_o}{f_e}$$

[Open Calculator !\[\]\(cbe80b694ebd74fcfe136a095b608235_img.jpg\)](#)

$$\text{ex } 29 = \left(1 + \frac{4\text{cm}}{25\text{cm}}\right) \cdot \frac{100\text{cm}}{4\text{cm}}$$

5) Magnifying Power of Galilean Telescope when Image Forms at Infinity

$$\text{fx } M = \frac{f_o}{f_e}$$

[Open Calculator !\[\]\(3e2231b1ad3ca8da8658228c00dd08e0_img.jpg\)](#)

$$\text{ex } 25 = \frac{100\text{cm}}{4\text{cm}}$$

Compound Microscope

6) Length of Compound Microscope

$$\text{fx } L = V_0 + \frac{D \cdot f_e}{D + f_e}$$

[Open Calculator !\[\]\(b792654f2cef9719eabeb6c5be00811e_img.jpg\)](#)

$$\text{ex } 8.448276\text{cm} = 5\text{cm} + \frac{25\text{cm} \cdot 4\text{cm}}{25\text{cm} + 4\text{cm}}$$



7) Length of Compound Microscope when Image Forms at Infinity

$$fx \quad L = V_0 + f_e$$

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

$$ex \quad 9cm = 5cm + 4cm$$

8) Magnification of Eyepiece when Image Formed at Least Distance of Distinct Vision

$$fx \quad M_e = M \cdot \left(\frac{U_0 + f_o}{f_o} \right)$$

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

$$ex \quad 12.375 = 11 \cdot \left(\frac{12.5cm + 100cm}{100cm} \right)$$

9) Magnification of Objective Lens when Image Formed at Least Distance of Distinct Vision

$$fx \quad M_o = \frac{M}{1 + \frac{D}{f_e}}$$

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

$$ex \quad 1.517241 = \frac{11}{1 + \frac{25cm}{4cm}}$$

10) Magnifying Power of Compound Microscope

$$fx \quad M = \left(1 + \frac{D}{f_e} \right) \cdot \frac{V_0}{U_0}$$

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

$$ex \quad 2.9 = \left(1 + \frac{25cm}{4cm} \right) \cdot \frac{5cm}{12.5cm}$$



11) Magnifying Power of Compound Microscope at Infinity

$$\text{fx } M = \frac{V_0 \cdot D}{U_0 \cdot f_e}$$

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

$$\text{ex } 2.5 = \frac{5\text{cm} \cdot 25\text{cm}}{12.5\text{cm} \cdot 4\text{cm}}$$

Resolving Limit

12) Resolving Limit of Microscope

$$\text{fx } \text{RL} = \frac{\lambda}{2 \cdot \text{RI} \cdot \sin(\theta)}$$

[Open Calculator !\[\]\(8bba887393ca45b761e5cb49e755e762_img.jpg\)](#)

$$\text{ex } 1.6\text{E}^{-9} = \frac{2.1\text{nm}}{2 \cdot 1.333 \cdot \sin(30^\circ)}$$

13) Resolving Limit of Telescope

$$\text{fx } \text{RL} = 1.22 \cdot \frac{\lambda}{a}$$

[Open Calculator !\[\]\(0fb13ad0bfa3d86868cdd3883e5665b3_img.jpg\)](#)

$$\text{ex } 7.3\text{E}^{-10} = 1.22 \cdot \frac{2.1\text{nm}}{3.5}$$



14) Resolving Power of Microscope

$$\text{fx } \text{RP} = \frac{2 \cdot \text{RI} \cdot \sin(\theta)}{\lambda}$$

[Open Calculator !\[\]\(d3fb9f94af8b26d1c844efa9a98805b0_img.jpg\)](#)

$$\text{ex } 6.3\text{E}^8 = \frac{2 \cdot 1.333 \cdot \sin(30^\circ)}{2.1\text{nm}}$$

15) Resolving Power of Telescope

$$\text{fx } \text{RP} = \frac{a}{1.22 \cdot \lambda}$$

[Open Calculator !\[\]\(e1d6102fe77919492c04879c8450f1f5_img.jpg\)](#)

$$\text{ex } 1.4\text{E}^9 = \frac{3.5}{1.22 \cdot 2.1\text{nm}}$$

Simple microscope


16) Focal Length of Simple Microscope when Image Forms at Least Distance of Distinct Vision

$$\text{fx } F_{\text{convex lens}} = \frac{D}{M - 1}$$

[Open Calculator !\[\]\(104fbf564e2e5a8fbd84f31656d114c7_img.jpg\)](#)

$$\text{ex } 2.5\text{cm} = \frac{25\text{cm}}{11 - 1}$$



17) Magnifying Power of Simple Microscope 

$$\text{fx } M = 1 + \frac{D}{F_{\text{convex lens}}}$$

Open Calculator 

$$\text{ex } 5 = 1 + \frac{25\text{cm}}{6.25\text{cm}}$$

18) Magnifying Power of Simple Microscope when Image Formed at Infinity 

$$\text{fx } M = \frac{D}{F_{\text{convex lens}}}$$

Open Calculator 


$$\text{ex } 4 = \frac{25\text{cm}}{6.25\text{cm}}$$

Terrestrial Telescope 19) Length of Terrestrial Telescope 

$$\text{fx } L_{\text{telescope}} = f_o + 4 \cdot f + \frac{D \cdot f_e}{D + f_e}$$

Open Calculator 

$$\text{ex } 113.4483\text{cm} = 100\text{cm} + 4 \cdot 2.5\text{cm} + \frac{25\text{cm} \cdot 4\text{cm}}{25\text{cm} + 4\text{cm}}$$

20) Length of Terrestrial Telescope when Image Forms at Infinity 

$$\text{fx } L_{\text{telescope}} = f_o + f_e + 4 \cdot f$$

Open Calculator 

$$\text{ex } 114\text{cm} = 100\text{cm} + 4\text{cm} + 4 \cdot 2.5\text{cm}$$



21) Magnifying Power of Terrestrial Telescope when Image Forms at Infinity

$$\text{fx } M = \frac{f_o}{f_e}$$

[Open Calculator !\[\]\(6605b201d6f14d9b3bcb8ab5f274d107_img.jpg\)](#)

$$\text{ex } 25 = \frac{100\text{cm}}{4\text{cm}}$$

22) Magnifying Power of Terrestrial Telescope when Image Forms at Least Distance of Distinct Vision

$$\text{fx } M = \left(1 + \frac{f_e}{D}\right) \cdot \frac{f_o}{f_e}$$

[Open Calculator !\[\]\(e8fb589d58dad1692debababa5e928b6_img.jpg\)](#)

$$\text{ex } 29 = \left(1 + \frac{4\text{cm}}{25\text{cm}}\right) \cdot \frac{100\text{cm}}{4\text{cm}}$$






Variables Used

- **a** Aperture of Objective
- **D** Least Distance of Distinct Vision (*Centimeter*)
- **f** Focal Length of Erecting lens (*Centimeter*)
- **F_{convex lens}** Focal Length of Convex Lens (*Centimeter*)
- **f_e** Focal Length of Eyepiece (*Centimeter*)
- **f_o** Focal Length of Objective (*Centimeter*)
- **L** Length of Microscope (*Centimeter*)
- **L_{telescope}** Length of Telescope (*Centimeter*)
- **M** Magnifying Power
- **M_e** Magnification of Eyepiece
- **M_o** Magnification of Objective Lens
- **RI** Refractive Index
- **RL** Resolving Limit
- **RP** Resolving Power
- **U₀** Object Distance (*Centimeter*)
- **V₀** Distance between Two Lens (*Centimeter*)
- **θ** Theta (*Degree*)
- **λ** Wavelength (*Nanometer*)










Constants, Functions, Measurements used

- **Function:** **sin**, $\sin(\text{Angle})$
Trigonometric sine function
- **Measurement:** **Length** in Centimeter (cm)
Length Unit Conversion 
- **Measurement:** **Angle** in Degree ($^{\circ}$)
Angle Unit Conversion 
- **Measurement:** **Wavelength** in Nanometer (nm)
Wavelength Unit Conversion 



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