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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

Open Calculator

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

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

2) Length of Astronomical Telescope when Image Forms at Infinity

Open Calculator

fx $$L_{telescope} = f_o + f_e$$

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

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

Open Calculator

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

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

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

Open Calculator

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

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

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

Open Calculator

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

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

Compound Microscope

6) Length of Compound Microscope

Open Calculator

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

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

7) Length of Compound Microscope when Image Forms at Infinity

Open Calculator

fx $$L = V_0 + f_e$$

ex $$9\text{cm} = 5\text{cm} + 4\text{cm}$$

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

Open Calculator

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

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

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

Open Calculator

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

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

10) Magnifying Power of Compound Microscope

Open Calculator

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

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

11) Magnifying Power of Compound Microscope at Infinity

Open Calculator

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

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

Open Calculator

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

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

13) Resolving Limit of Telescope

Open Calculator

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

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

14) Resolving Power of Microscope

Open Calculator

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

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

15) Resolving Power of Telescope

Open Calculator

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

ex $$1.4\mathrm{E}\hat{}9 = \frac{3.5}{1.22 \cdot 2.1\mathrm{nm}}$$

Simple microscope

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

Open Calculator

fx $$\mathrm{F}_{\text{convex lens}} = \frac{\mathrm{D}}{\mathrm{M} - 1}$$

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

17) Magnifying Power of Simple Microscope

Open Calculator

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

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

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

Open Calculator

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

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

Terrestrial Telescope

19) Length of Terrestrial Telescope

Open Calculator

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

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

20) Length of Terrestrial Telescope when Image Forms at Infinity

Open Calculator

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

ex $$114cm = 100cm + 4cm + 4 \cdot 2.5cm$$

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

Open Calculator

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

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

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

Open Calculator

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

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

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
- U_0 Object Distance *(Centimeter)*
- V_0 Distance between Two Lens *(Centimeter)*
- **θ** Theta *(Degree)*
- **λ** Wavelength *(Nanometer)*

Constants, Functions, Measurements used

- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Measurement: **Length** in Centimeter (cm)
  Length Unit Conversion
- Measurement: **Angle** in Degree (°)
  Angle Unit Conversion
- Measurement: **Wavelength** in Nanometer (nm)
  Wavelength Unit Conversion

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