Basic SI Units

demonstrating the conversion of angles from degrees, minutes of arc (arcminutes), and seconds of arc (arcseconds) to radians. Let's go through each part of the problem step by step.

Problem Statement

Calculate the angle of:
(a) 1° (degree)
(b) 1′ (minute of arc or arcminute)
(c) 1″ (second of arc or arcsecond) in radians.

Use:

- $360° = 2\pi$ rad
- $1° = 60'$
- $1' = 60"$

Solution

(a) Converting 1° to Radians

1. **Given:**

$$360° = 2\pi \text{ rad}$$

2. **Formula:**

$$1° = (\frac{\pi}{180}) \text{ rad}$$

3. **Calculation:**

$$1° = (\frac{\pi}{180}) \text{ rad} \approx 1.745 \times 10^{-2} \text{ rad}$$

(b) Converting 1′ (Minute of Arc) to Radians

1. **Given:**

$$1° = 60'$$

$$1° \approx 1.745 \times 10^{-2} \text{ rad}$$

2. **Formula:**

$$1' = (\frac{1^\circ}{60}) \text{ rad}$$

3. **Calculation:**

$$1' = (\frac{1.745 \times 10^{-2} \text{ rad}}{60}) \approx 2.908 \times 10^{-4} \text{ rad}$$

(c) Converting 1″ (Second of Arc) to Radians

1. **Given:**

$$1' = 60''$$

$$1' \approx 2.908 \times 10^{-4} \text{ rad}$$

2. **Formula:**

$$1'' = (\frac{1'}{60}) \text{ rad}$$

3. **Calculation:**

$$1'' = (\frac{2.908 \times 10^{-4} \text{ rad}}{60}) \approx 4.847 \times 10^{-6} \text{ rad}$$

This is further approximated to:

$$1'' \approx 4.85 \times 10^{-6} \text{ rad}$$

Summary

- **1° (degree):**

$$1^\circ \approx 1.745 \times 10^{-2} \text{ rad}$$

- **1′ (minute of arc or arcminute):**

$$1' \approx 2.908 \times 10^{-4} \text{ rad}$$

- **1″ (second of arc or arcsecond):**

$$1'' \approx 4.85 \times 10^{-6} \text{ rad}$$

These conversions are fundamental in various fields, especially in astronomy and navigation, where precise angular measurements are crucial. The radians unit is a natural unit for measuring angles in mathematics due to its direct relationship with the properties of the circle.