A Short Course in Astronomy and the Use of the Globes

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THE design of this work is to supply a brief course of lessons in astronomy for the use of young pupils, or of those whose time and opportunities do not permit a more exhaustive study of the subject. It is based on the author's "New Manual of the Elements of Astronomy," of which, in some respects, it is an abridgment; but many parts of the work have been greatly simplified, and the arrangement of topics has been somewhat changed, so as to be adapted to a work of lower grade.

The objective plan of instruction has been followed as far as it is applicable to the subject under treatment, the pupil's attention being constantly directed to the phenomena addressed to his own observation, and the reasoning made to proceed directly from them. Section First will, it is believed, be found especially useful in the accomplishment of this object, by awakening, at the commencement, an interest in astronomical observation, as the basis of all subsequent study of the science.

Throughout the work, the arrangement of the paragraphs is adapted to the topical method of recitation—so desirable, as far as is practicable, in every branch of study, in order to train the pupil in habits of connected and logical statement.
Questions have been, however, appended at the foot of each page, in order to facilitate the more minute examination of the pupil on the text.

The Astronomical Index will be found useful and convenient in affording a brief summary of definitions, for final review. The Problems for the Globe have been placed in connection with those parts of the work to which they seemed most intimately to belong, and where they can best be studied with the view to illustrate more fully the principles laid down.

The author hopes that, by presenting the fundamental principles and most interesting facts of astronomy in this simplified and condensed form, he may aid in inducing a more general study of this useful and sublime science in the public and private seminaries throughout the country, from which it is too often excluded, to make way for subjects of far less value, both in respect to educational discipline and practical information.

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INTRODUCTION.

MATHEMATICAL DEFINITIONS.

1. **Extension**, or magnitude, may be measured in three directions; namely, length, breadth, and thickness. These are therefore called the *dimensions of extension*.

   Length is the greatest dimension; Thickness, the shortest; Breadth, the other.

2. **A Line** is that which is conceived to have only one dimension.

   Lines have no real existence independently of extension, or solidity. They are purely abstract or imaginary quantities: the marks called lines are only representatives of them.

3. **A Straight Line** is a line that does not change its direction at any point.

4. **A Curve Line** is one that changes its direction at every point.

5. **A Point** is that which is conceived to have no dimensions, but only position.

   A point is represented by a dot (•).

6. A **Surface** is that which is conceived to have two dimensions—length and breadth.

7. A **Plane Surface, or Plane**, is a surface with which, if a straight line coincide in two points, it will coincide in all.

That is, a straight line cannot lie partly in a plane, and partly out of it; and if applied to it in any direction, it will coincide with it throughout its whole extent. The term *plane* does not imply any limitation, or boundary, but signifies indefinite direction, without change, both as to length and breadth.

8. A plane bounded by lines is called a **Plane Figure**.

9. A **Circle** is a plane figure bounded by a curve line every point of which is equally distant from a point within, called the centre.

10. The curve line that bounds a circle is called the **Circumference**.

11. The **Diameter** of a circle is a straight line drawn through its centre from one point of the circumference to another.

12. The **Radius** is a straight line drawn from the centre to the circumference.

13. An **Arc** is any part of the circumference.

14. A **Tangent** is a line which touches the circumference in one point.
15. A Semicircle is one-half of a circle; a Quadrant is a quarter of a circle.

16. The circumference of a circle is supposed to be divided into 360 degrees, each degree into 60 minutes, and each minute into 60 seconds.

   Degrees are marked (°); minutes, ('); and seconds, (").

17. An Angle is the difference in direction of two straight lines that meet at a point, called the vertex.

   It is of the greatest importance that the student of Astronomy should form a clear idea of an angle, since nearly the whole of astronomical investigation is based upon it. The apparent distance of two objects from each other, as seen from a remote point of view, depends upon the difference of direction in which they are respectively viewed; that is to say, the angle formed by the two lines conceived to be drawn from the objects, and meeting at the eye of the observer. This is called the angular distance of the objects, and, as will readily be understood, increases as the two objects depart from each other and from the general line of view.

18. The Angle of Vision, or Visual Angle, is the angle formed by lines drawn from two opposite points of a distant object, and meeting at the eye of the observer.

It will be easily seen that, as the apparent size of a distant object depends upon the angle of vision under which it is viewed, it must diminish as the distance increases, and vice versa.

Thus, the object A B is viewed under the angle A P B, which determines its apparent size in that position; but when removed farther from the eye, as at C D, the angle of vision becomes C P D, an angle obviously smaller than A P B, and hence the object appears smaller. At E F, the object appears larger, because the visual angle E P F is larger. The farther the object is removed, the less the divergence of the lines which form the sides of the angle; and the nearer the object is brought to the eye, the greater the divergence of the lines.

19. An angle is measured by drawing a circle, with the vertex as a centre, and with any radius, and finding the number of degrees or parts of a degree included between the sides.

20. A Right Angle is one that contains 90 degrees, or one-quarter of the circumference.

21. When one straight line meets another so as to form a right angle with it, it is said to be perpendicular.

22. A straight line is said to be perpendicular to a circle when it passes, or would pass if prolonged, through the centre.

23. An angle less than a right angle is called an Acute Angle; one greater than a right angle is called an Obtuse Angle.
In the annexed diagram, the semi-circumference is used to measure all the angles having their vertices, or angular points, at C. Thus BCD, containing the arc BD, is an angle of 45°; BCE, an angle of 90°; and BCF, of 120°. The points A and B are at the angular distance of 180°, or two right angles from each other.

24. A Triangle is a plane figure bounded by three sides.

A triangle that contains a right angle is called a Right-angled Triangle.

A triangle having equal sides is called an Equilateral Triangle.

25. Parallel Lines are those situated in the same plane, and at the same distance from each other, at all points.

Parallel lines may be either straight or curved.

The circumferences of concentric circles, that is, circles drawn around the same centre, are parallel.

26. An Ellipse is a curve line, from any point of which if straight lines be drawn to two points within, called the foci, the sum of these lines will be always the same.