36. Paper 1. (Written.)

KNOWLEDGE OF PRINCIPLES. (3 hours.)

(a) The reading of simple graphical diagrams—e.g., stability curves, weather statistics, &c.

(b) The practical use of logarithms to base 10; their use in simple calculations involving multiplication, division, simple powers, and roots.

(c) Areas and perimeters of rectangle, triangle, circle, volumes, and surface areas of box-shaped bodies, cylinders, and wedges. Practical applications—e.g., weight of general cargo of varied shapes; capacities of holds and bunkers; weight of contents of bunkers.

(d) Plane sections of a sphere. Great and small circles. Angle between two great circles. Shortest distance between two points on a sphere. Formation of spherical triangles. Sides and angles of spherical triangles.

(e) Trigonometrical ratios—sine, cosine, tangent, cosecant, secant, cotangent; haversine.

The simple relations between these ratios. The relation between the ratios of angles which together make (a) one right angle (b) two right angles—e.g., the sine of an angle = the cosine of its complement, &c.

The solution of a plane right-angled triangle. Use of the Traverse Table for solving right-angled triangles. Practical problems on right-angled triangles—e.g., doubling the angle on the bow, four-point bearing, danger angles, distance from a point of land of known height, &c.

(f) Given two sides and the included angle of a spherical triangle, to find the third side.

Given three sides of a spherical triangle to find any angle. (These two problems are preferably done by the use of the haversine formulæ.)

A general understanding of the following :—

(g) The earth and its daily and annual movements. Meaning of equator and poles. The position of a place fixed by its latitude and longitude; meridians. Distances measured on the earth; nautical mile; departure. To show clearly, but without proof, the connection between departure, difference of longitude and middle latitude.

(h) The real movement of sun, moon, and planets. The celestial sphere; celestial poles; celestial meridian above and below pole; zenith; celestial equator. Altitude and zenith distance of heavenly bodies; celestial horizon; prime vertical; circles of altitude.

(i) Apparent movements of heavenly bodies. Declination. Rising and setting of heavenly bodies. Amplitude. The position of a heavenly body on the celestial sphere both with and without reference to the observer—i.e., Declination with Right Ascension or Azimuth with altitude. Azimuth.

(j) Apparent movement of sun. Mean sun. Ecliptic. Length of day and night. First point of Aries. Right ascension. Right Ascension of mean sun.

(k) General ideas on time. Hour angle. Greenwich and other standard times. Simultaneous hour angles of heavenly bodies in different places. Sidereal time. Relation of longitude and time. Equation of time. Mean and apparent times at Greenwich and elsewhere.

(l) Hour angle of heavenly body + Right Ascension of heavenly body = Hour Angle of Mean Sun + Right Ascension of Mean Sun.

The meaning of E. and R. in the Nautical Almanac.

(m) Correction of sextant altitudes. True horizon and visual horizon; dip of the horizon. Effect of atmosphere, refraction. Semidiameter. Parallax.

(n) Geographical position of heavenly body.

The simple explanation of the " Circle of position " on the earth, based on the three following facts :—

Zenith Distance of heavenly body = distance of geographical position from an observer.

Latitude of geographical position = Declination of heavenly body.

Longitude of geographical position = Hour Angle of heavenly body west of the meridian of Greenwich.