1.5 = \$1.5225. ∴ He holds 1.015 shares for every time 1.5225 is contained in 410, i.e., $273\frac{1}{3}$ shares. That is, he holds $273\frac{1}{3}$ shares of \$100 each, and these are worth in cash 120 times $273\frac{1}{3}$, or 32800 dollars.

9. What sum of money invested at 5% per annum, compounded yearly, will, at the end of 4 years, provide for a perpetual annuity of \$100.

\$1 at 5%, for 4 years amounts to $(1.05)^4$. The annual interest on this amount at 5% is $\frac{1}{20}(1.05)^4$.

∴ The sum required is $100 \div \frac{1}{20}(105)^4$ or, $\frac{2000}{(1.05)^4}$ i.e., \$1645.41 nearly

10. An agent's rate of commission for selling is four-fifths of his rate for buying. He sold a consignment for \$10200, and, after deducting \$450, invested the balance. What did he charge for selling?

He sold \$10200, and invested, or bought, \$9750, and the \$450 is to pay both commissions.

Let his rate for selling be s, then his rate of buying is $\frac{5}{4}s$.

∴ Commission for selling $= 10200 \times s$, and the commission for buying $= 9750 \times \frac{5}{4}s$, and the sum of these is \$450. Whence $s = \frac{4}{199}$, or 2 ^{2} %

11. Two candles are of equal length. The one is consumed uniformly in 4 hours, and the other in 5 hours. If the candles are lighted at the same. time, when will one be three times as long as the other?

Denote the length of the candles by units, one shortens by $^1/_4$, and the other by $^1/_5$ per hour.

After t hours the length of the longer piece will be $1 - {}^t/_5$, and of the shorter, $1 - {}^t/_4$.

∴ $1 - {}^t/_5 = 3(1 - {}^t/_7)$, whence $t = 3^7/_{11}$ hours.

12. Calculate the number of acres in the surface of the earth, considering the earth a sphere 8000 miles in diameter.

The area of the surface of a sphere is equal to that of four great circles $= 4\pi r^2$. But $r = 4000$ and there are 640 acres in a square mile.

∴ $640 \times 4\pi(4000)^2 = 40960000000\pi$ acres.

13. Find the external diameter of an iron spherical shell whose weight is equal to the sum of the weights of two iron spheres whose diameters are 6 in. and 10 in. respectively, the internal diameter of the shell being 8 in.

Let r be the external radius required.

Balance of shell $= {}^4/_3\pi r^3 - {}^4/_3\pi.4^3 = {}^4/_3\pi(r^3 - 4^3)$; and the volume of the spheres is ${}^4/_3\pi(3^3 + 5^3)$; and these are to be equal.

∴ $r^3 = 5^3 + 3^3 + 4^3 = 6^3$, and $2r = 12$ in.—Ans.

14. Find the volume of a right circular cone whose curved surface may be formed by bringing together the bounding radii of a sector of a circle, the radius of the circle being 7 feet, and the angle of the sector 60°

The length of an arc of 1° for radius 1 is .01745

∴ The length of arc of the sector is $.01745 \times 60 \times 7 = 7.329$, and this is the circumference of the base of the cone.

The radius of the base is $7.329 \div 2\pi = r$, say

Then the altitude is $\sqrt{(7^2 - r^2)} = a$, say.

Finally, the volume is:

$$\tfrac{1}{3}\pi r^2.a = \tfrac{1}{3}\pi\left(\frac{7.329}{2\pi}\right)^2 \sqrt{\left\{7^2 - \left(\frac{7.329}{2\pi}\right)^2\right\}}$$