

GP1-L01

Problem 1

Earth is approximately a sphere of radius 6.37×10^6 m . What are (a) its circumference in kilometers, (b) its surface area in square kilometers, and (c) its volume in cubic kilometer? (03小題)

(a)its circumference in kilometers=_____km

01: ANS:=4E4

(b)its surface area in square kilometers=_____km²

02: ANS:=5.1E8

(c)its volume in cubic kilometer=_____km³

03: ANS:=1.08E12

Solution:

(a)周長= $2\pi R = 2(3.14)(6.37 \times 10^6 \times 10^{-3})\text{km} = 4 \times 10^4$

(b)表面積= $4\pi R^2 = 4(3.14)(6.7 \times 10^3)^2\text{km}^2 = 5.1 \times 10^8\text{km}^2$

(c)體積= $\frac{4}{3}\pi R^3 = \frac{4}{3}(3.14)(6.37 \times 10^3)^3\text{km}^3 = 1.08 \times 10^{12}\text{km}^3$

Problem 2

(a)請上網查詢地球的半徑和地球的質量並且計算地球的平均密度。(b)同樣的請你計算太陽的平均密度。(c)將地球視為一個完美的球體請計算地球的表面積。(03小題)

(a)地球的平均密度=_____ kg/m³

04: ANS:=6E24/(4*pi*(6.4E6)3/3).**

(b)太陽的平均密度=_____ kg/m³

05: ANS:=2E30/(4*pi*(6.96E8)3/3).**

(c)地球的表面積=_____ m²

06: ANS:=4*pi*(6.4E62).**

Problem 3

Antarctica is roughly  semicircular, with a radius of 2000km (the figure). The average thickness of its ice cover is 3000 m. How many cubic centimeters of ice does Antarctica contain? (Ignore the curvature of Earth.)

南極洲大致呈半圓形，半徑為2000km（如圖）。其冰蓋平均厚度為3000米。南極洲有多少立方厘米的冰？（忽略地球的曲率。）（01小題）

V=_____cm³

07: ANS:=1.88E22

Solution:

$$\frac{1}{2}\pi R^2 h = \frac{1}{2}(3.14)(2000\text{km})^2(3000\text{m})$$

$$= \frac{1}{2}(3.14)(2000 \times 10^5\text{cm})^2(3000 \times 10^2\text{cm})$$

$$= 1.88 \times 10^{22}\text{cm}^3$$

Problem 4

The fastest growing plant on record is a *Hesperoyucca whipplei* that grew 3.7 m in 14 days. What was its growth rate in micrometers per second?

有史生長最快的植物是 *Hesperoyucca whipplei*，它在14天長3.7公尺。試問其生長速度為每秒多少微米？（01小題）

what is the answer=_____μm/s

08: ANS:=3.06

Solution:

$$\frac{3.7m}{14d} = \frac{3.7 \times 10^6 \mu m}{14d \times \frac{24h}{1d} \times \frac{60min}{1h} \times \frac{60sec}{1min}} = 3.06 \mu m/s$$

Problem 5

測量地球半徑

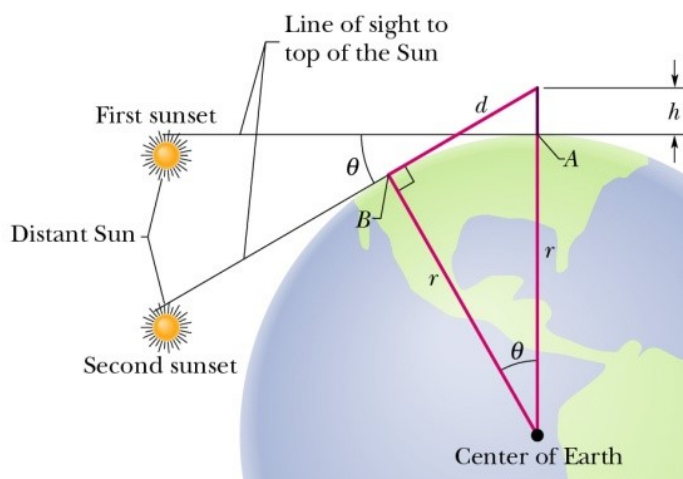
Suppose that, while lying on a beach near the equator watching the Sun set over a calm ocean. You then stand, elevating your eyes by a height $H = 1.7m$, and stop the watch when the top of the Sun again disappears. If the elapsed time is $t = 11.1s$, what is the radius of Earth?

假設，躺在赤道附近的海灘上，看著太陽從平靜的海洋上落下。然後你站起來，將你的眼睛抬高 $H = 1.7m$ ，當太陽的頂部再次消失時停止手錶。如果經過的時間是 $t = 11.1s$ ，地球的半徑是多少？(01小題)

the radius of Earth=_____m

09: ANS:=5.2E6

Solution:



$$d^2 + r^2 = (r + h)^2$$

$$d^2 = 2rh + h^2 \approx 2rh \text{ (因為 } r \gg h \text{)}$$

$$\frac{24h}{360^\circ} = \frac{t}{\theta}$$

$$\theta = \frac{(360^\circ)(11.1\text{s})}{(24\text{h})(60\text{min/h})(60\text{s/min})} = 0.04625^\circ$$

$$\text{因為 } d = r \tan \theta$$

$$\text{又 } d^2 = 2rh + h^2 \approx 2rh$$

$$\text{所以 } r^2 \tan^2 \theta = 2rh$$

$$r = \frac{2h}{\tan^2 \theta} = \frac{2(1.7\text{m})}{\tan^2 0.04625} = 5.2 \times 10^6 \text{m}$$

Problem 6

Earth has a mass of 5.98×10^{24} kg . The average mass of the atoms that make up Earth is 40 u. How many atoms are there in Earth?

地球的質量為 5.98×10^{24} kg 。 構成地球的原子的平均質量為 40 u 。 地球上有多少個原子？ (01小題)

the number=_____

10: ANS:=9E49

Solution:

$$1u = 1.66 \times 10^{-27} \text{ kg}$$

$$\frac{5.98 \times 10^{24} \text{kg}}{40 \times (1.66 \times 10^{-27}) \text{kg}} = 9 \times 10^{49}$$