



**UNIVERSITY OF SRI JAYEWARDANEPURA**

B.Sc. General/Special Degree Third Year Course Unit Examination –  
October, 2018.

**PHY 310 1.0 / PHY 329 1.0 / PHY 373 1.0 – Space Physics - I**

Time : One hour

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**Answer all questions**

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- 01.** Show that the variation of molecular number density  $N(h)$  with the altitude  $h$  of an isothermal atmosphere which is consisting of only one type of gas molecules of mass  $m$  can be expressed as,

$$N(h) = N_0 e^{-\frac{h}{H}},$$

**assuming**  $T$  and  $g$  are constants where,  $H = \frac{kT}{mg}$  and  $T$  is the temperature,  $g$  is the acceleration due to gravity and  $k$  is the Boltzmann Constant.

In the Earth's atmosphere, the major constituents are Nitrogen and Oxygen having average molecular mass of  $4.8 \times 10^{-26}$  kg. The total number density  $N_0 = 2.54 \times 10^{19} \text{ cm}^{-3}$  at the ground.

**Estimate** the molecular number density at an altitude of 6.0 km and 8.4 km.

You may assume that,  $g = 10 \text{ ms}^{-2}$ ,  $k = 1.38 \times 10^{-23} \text{ JK}^{-1}$  and  $T = 288 \text{ K}$ .

**P. T. O**

**02.** Show that the resonance frequency  $f_p$  of the plasma oscillations of an ionized electrically neutral medium containing free charges of mass  $m$  is given by;

$$f_p = \frac{e}{2\pi} \left( \frac{N}{\epsilon_0 m} \right)^{1/2} .$$

Where,  $N$  is the number density of free charges,  $\epsilon_0 = 8.85 \times 10^{-12} \text{ Fm}^{-1}$  and  $e = 1.6 \times 10^{-19} \text{ C}$ .

Estimate the highest frequency that can be reflected from the ionosphere at normal incidence if the maximum electron density in the ionosphere is  $2.0 \times 10^{12} \text{ m}^{-3}$ . (Mass of the electron is  $9.1 \times 10^{-31} \text{ kg}$ )

Which of the following radio wave bands get reflected from the ionosphere at normal incidence?

<b>Band</b>	<b>Frequency Range</b>
VLF	3 kHz – 30 kHz
LF	30 kHz – 300 kHz
MF	300 kHz – 3 MHz
SW	3 MHz – 30 MHz
VHF	30 MHz – 300 MHz
UHF	300 MHz – 3 GHz

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