



EASTERN UNIVERSITY, SRI LANKA
THIRD EXAMINATION IN SCIENCE – 2009/2010
SECOND SEMESTER (SPECIAL REPEAT)
FEBRUARY/MARCH 2013
PH 306 ENVIRONMENTAL PHYSICS

Time: 01 hour

Answer ALL Questions

You may use the following information useful.

Gravitational acceleration $g = 9.81 \text{ m/s}^2$

Molar mass of air $M = 0.02896 \text{ kg/mol}$

Universal gas constant $R = 8.31 \text{ J/mol.K}$

Universal Gravitational constant $G = 6.67 \times 10^{-11} \text{ N.m}^2/\text{kg}^2$

Mass of the earth $M_E = 5.98 \times 10^{24} \text{ kg}$

Radius of the earth $R_E = 6378 \text{ km}$

1. (a) Sketch the temperature profile of the atmosphere as a function of altitude. Explain in what ways does the troposphere differ from the stratosphere?

(b) The atmospheric pressure P_h at a height h from the ground is expressed by the relation

$$P_h = P_0 \exp\left(-\frac{Mgh}{RT}\right)$$

where P_0 are the average atmospheric pressure at the sea level, M is the molar mass of air, T is the temperature, and the other symbols have their usual meanings.

Find the atmospheric pressure in a gold mine at a depth of 1 km at the temperature of 313 K. Given that the atmospheric pressure at the sea level is 760 mm/Hg.

(c) Derive relevant expression to determine the escape velocity of a rocket on earth with respect to earth's gravitational field.

2. (a) Name the group of man-made chemicals that contributes mostly to the ozone depletion in the stratosphere and explain the mechanism of depletion.

(b) Assuming that the earth emits terrestrial radiation as a spherical black-body show that the Earth's effective temperature T_E is given by

$$T_E = \left(\frac{S(1-a)}{4\sigma}\right)^{\frac{1}{4}}$$

where S is the solar constant, a is the average global albedo, and σ is the Stefan-Boltzmann constant.

(c) List the main four greenhouse gases, and explain how the greenhouse effect contributes to global warming.