EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE - 2005/2006

SECOND SEMESTER (SPECIAL REPEAT)

PH 306 ENVIRONMENTAL PHYSICS

Time: 01 hour.

Answer ALL Questions

Gravitational acceleration $g = 9{:}8\ m\ s^{-2}$

Radius of the Earth $R_E = 6.37 \times 10^6\ m$

Universal gas constant $R = 8.31\ J\ K^{-1}\ mol^{-1}$

Specific heat of water $= 4.18 \times 10^6\ \mathrm{J\ m^{-3}\ K^{-1}}$

Stefan's constant $= 5.67 \times 10^{-8} W\ m^{-2}\ K^{-4}$

1. List the four principal layers of the atmosphere in order from the Earth's surface upwards. Within each of these layers, state how the temperature varies with height

(a) The density of air is 1.2 kg m^{-3} at the Earth's surface. Calculate the height of the column of air required to exret a pressure of 1 atmosphere (1×10^5 Pa) at its base.

(b) At constant temperature the pressure of the atmosphere decreases exponentially with height according to the equation $P=P_o\, e^{-kh}$ where P_o is the pressure at the Earth's surface and other symbols have their usual meanings. Given that P at a height of 5 km is approximately 0.5 P_o estimate the height at which P will have fallen to (1/8) P_o.

2. Describe what is meant by primary energy and list three global energy resources. Briefly explain the importance of the renewable energy.
The simplest method of harnessing the energy from the Sun is to transfer it into a liquid.

A Flat plate solar collector of area A is incident by solar radiation that has G solar irradiance perpendicular to the collector of which a fraction t is transmitted and a fraction a is absorbed. If the energy losses through convection, radiation and conduction are ignored show that the capture efficiency can be given as:

$$n = ta\text{-}(T_p - T_a)/(RAG)$$

where T_a is the temperature of the working fluid entering, T_p is the emergent temperature and R is the thermal resistance for energy loss from the collector.