EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE - 2007/2008

SECOND SEMESTER (SPECIAL REPEAT)

(February 2010)

PH 306 ENVIRONMENTAL PHYSICS

Time: 01 hour.

Answer ALL Questions

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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 exert 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.

   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. Define the terms solar constant, planetary albedo and Green house effect.

The energy received by any planet is inversely proportional to its distance from the sun.

(a) Calculate the solar constant for the planet Venus, given that the mean distance of Venus from the Sun is 72% of that of the Earth.

(b) If the albedo of Venus is 0.76, calculate the temperature of the apparent surface (the top of the cloud layer that covers the planet) by considering the overall radiation balance of the planet.

(c) Suppose that all the un-reflected solar radiation passes through the cloud layer and is absorbed at the planet's surface, and the cloud layer radiates equally well in the upward and downward direction.

i. Draw a diagram to show the energy flows within the Venusians' atmosphere.

ii. Hence use an energy balance argument to estimate the surface temperature of Venus.

iii. The real surface temperature of Venus is estimated to be about 700K. Discuss reasons for the discrepancy between this value and the one you have calculated.

(Solar constant of the Earth =1352 W m^{-2} and Stefan constant (σ) =56.7 n W m^{-2} K^{-4})