EASTERN UNIVERSITY, SRI LANKA

THIRD EXAMINATION IN SCIENCE - 2007/2008

SECOND SEMESTER (PROPER/REPEAT)

(October/November 2010)

PH 306 ENVIRONMENTAL PHYSICS

Time: 01 hour.

Answer ALL Questions

Density of water = 1000 $kg\ m^{-3}$

Atmospheric pressure at sea level = $10^5\ Pa$

Acceleration due to gravity = 9.8 ms^{-2}

Stefan's constant (σ) = 5.67 × $10^{-8}\ W\ m^{-2}\ K^{-4}$

Solar constant of the Earth =1352 W m^{-2}

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

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

1. Sketch the temperature profile of the atmosphere as a function of height up to 500 km. Explain the significance of each region. Briefly explain the Green house effect and Global warming and its effects.

At constant temperature the pressure of the atmosphere decreases exponentially with height according to the equation

$$P = P_o e^{-h/H}$$

where P_o is the pressure at the Earth's surface.

A cylindrical cloud with diameter 4km and height 5 km contains about 10^8 raindrops per cubic metre. If the mean radius of a raindrop is 10 μm, calculate the energy released when the cloud is formed assuming that the cloud condenses out adiabatically and the latent heat of water is $2.5 \times 10^6\ J\ kg^{-1}$.

Find the pressure on the top of the cloud if the base of the cloud is 1 km above the surface. You may assume that the scale height is 8.5 km and that the mean temperature of the atmosphere is 288 K which is constant with height.

2. Define and briefly comment on the terms, Planetary albedo and Black body radiation of a planet

Consider the thermal balance of Jupiter. The mean planetary radius of Jupiter is 69500 km; the mean radius of orbit around the Sun is 5.19 A.U. where 1A.U. is the mean radius of the Earth's orbit and the planetary albedo of the Jupiter is 0.51.

(a) Draw a diagram to show the thermal energy flows within the Jupiter's atmosphere.

(b) Assuming a balance between incoming and outgoing radiation, estimate the surface temperature of Jupiter.