SCHOOL : ENVIRONMENTAL SCIENCE
LEVEL : III
MODULE : ATMOSPHERIC SCIENCE
CODE : ENVS318

DURATION: 3 HOURS   **TOTAL MARKS: 300**

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INSTRUCTIONS: Answer THREE questions

1. a) Describe and explain three forms of attenuation of solar radiation in the atmosphere.

    (50)

    b) Using the First Law of Thermodynamics ($dh = c_p dT - dP/\rho$) and the hydrostatic equation ($dP/dz = -\rho g$), derive the dry adiabatic lapse rate of ~1°C per 100 m, and in doing so, define all terms. (Given: $g = 9.8$ m.s^{-2}, and $c_p = 1004$ J.Kg^{-1}.K^{-1}).

    (20)

    c) Using a well annotated diagram, explain the formation of lightning and thunder.

    (30)

2. Define the forces listed below and explain their balances in geostrophic, gradient and cyclostrophic flow. Use well annotated diagrams where necessary.

    *   Pressure gradient force

    *   Coriolis force

    *   Centrifugal force

    *   Frictional force

    (100)

3. Discuss the changes in geostrophic winds over space, time and surface type.

    (100)

4. Using the concepts of radiation budget **and** surface energy budget, explain the energy surplus at the equator and deficit at the poles.

    (100)