

THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE PROGRAMME- 2010/2011

FINAL EXAMINATION 2010

PHU 3145 / PHE 5145- ATMOSPHERIC PHYSICS

DURATION: TWO & HALF HOURS (2 1/2 HR)

DATE: 30.12.2010

TIME: 9. 30 a.m. – 12.00 Noon

ANSWER FOUR QUESTIONS ONLY.

01. (a) What is the meaning of "lapse rate" in the atmospheric physics?
- (b) Graphically represent the lapse rate in two dimensional axis system marked dry adiabatic lapse rate Γ_d and saturated adiabatic lapse rate Γ_s clearly in it.
- (c) Consider an environment in which the actual lapse rate Γ as measured by a radiosonde,
- less than dry adiabatic lapse rate,
 - equal to dry adiabatic lapse rate,
 - greater than dry adiabatic lapse rate.
- Explain the behavior of an unsaturated and saturated air under the above three conditions. Use diagrams whenever possible.
- (d) An unsaturated air parcel with density ρ' and temperature T' given a small upward displacement δz from its equilibrium level in a stably stratified atmosphere with density ρ and temperature T . Show that the restoring force acting on the parcel is given by the expression

$$g(T_d - T) \delta z / T$$

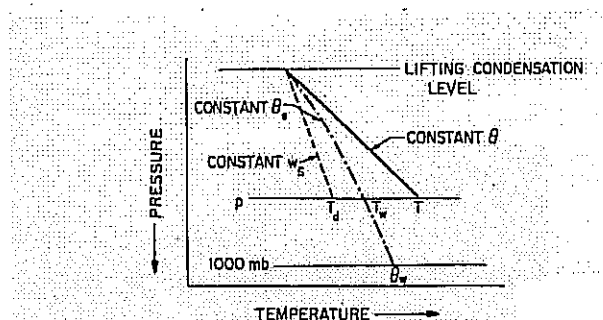
02. Answer the followings.

- Why it is necessary to convert station pressure to sea level pressure for weather forecasts?
- Explain why if a low pressure system is colder than its' surroundings, the amplitude of the pressure anomaly increases with height.
- Which of the following pairs of quantities are conserved when unsaturated air is lifted;
 - Potential temperature and mixing ratio.
 - Potential temperature and saturation mixing ratio.
 - Equivalent potential temperature and saturation mixing ratio.

Give explanatory notes to your answer.

03. (a) Explain the characteristics of each layer and regions of the atmosphere from surface up to 150km .
- (b) What is the role played by ozone in the stratosphere? What will happen to atmospheric layers if ozone is depleted in the stratosphere?
- (c) Explain how Aurora is formed and why it is confined to polar regions.

04. The following figure shows a selected portion of pseudo-adiabatic chart with some of the curves in it.



(i) Identify the symbols T_d , T_w and θ_w .

(ii) Define the followings.

Lifting condensation level

Saturation mixing ratio

Equivalent potential temperature

Wet bulb potential temperature and

Dew point temperature.

05. Explain the following

- (a). Tropical cyclone development is confined to a limited area of some tropical oceans. Provide scientific background for your explanation.
- (b). Hurricane and typhoons are large systems as compared to cyclones in the Indian Ocean.
- (c). How tropical cyclones help to reduce atmospheric temperature gradient in the horizontal and vertical directions.

06. (a). Justify the statement that "atmosphere is transparent to solar radiation" and explain why when radiation is considered the atmosphere is a heat sink and earth is a heat source.

(b). Explain how the energy balance is maintained in earth - atmosphere system.

(c). Explain the role played by different gases in the atmosphere when solar radiation passes through it.