RAJARATA UNIVERSITY OF SRI LANKA
FACULTY OF APPLIED SCIENCES

B.Sc. (General) Degree
Third Year – Semester II Examination – April / May 2015

PHY 3302 - METEOROLOGY

Answer **Six** Questions Only Time allowed: Three hours

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1. (a) Explain the difference between atmospheric **greenhouse effect** and **global warming**.

(4 marks)

(b) Which do you feel would have the greatest effect on the Earth's greenhouse effect: removing all of the CO_2 from the atmosphere or removing all of the water vapor? Explain your answer.

(3 marks)

(c) Define the term **albedo.** Why does the **albedo** of the Earth and its atmosphere average about 30%?

(3 marks)

2. (a) Explain how the atmosphere near the Earth's surface is warmed from below.

(2 marks)

(b) In the Northern Hemisphere, why are summers warmer than winters even though the earth is actually closer to the sun in January?

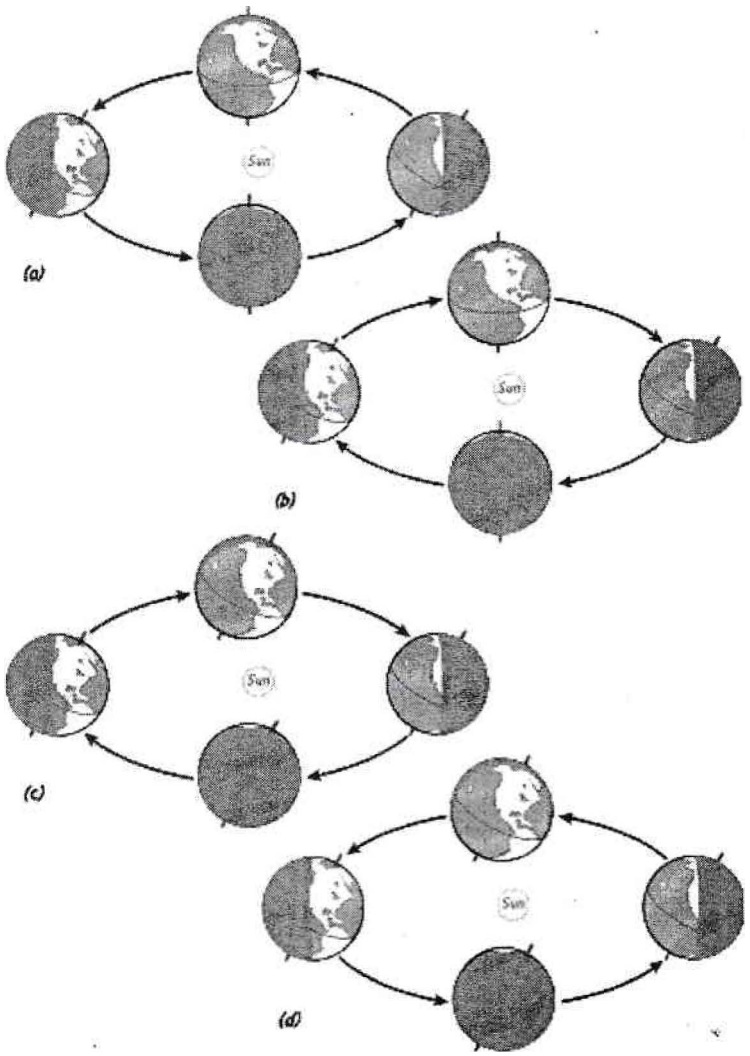
(2 marks)

(c) If the surface of a puddle of water **freezes**, is heat energy released to or taken from the air above the puddle? Briefly explain your answer.

(3 marks)

(d) The following diagrams are intended to illustrate the Earth-Sun relationship that gives rise to the seasons.

I. Which one of these diagrams most accurately shows this relationship?



(1 mar

II. How would the daylight hours of the Arctic Circle be affected if the tilt of the Earth's axis increased from 23 ½ ° to 40°?

(2 mar

Briefly explain the movement of water in the hydrologic cycle.

(3 marks

What Does saturation vapor pressure primarily depend upon?

(1 mark

(c) After completing a grueling semester of meteorological course work, you call your travel agent to arrange a much-needed summer vacation. When your agent suggests a trip to the desert, you decline because of a concern that the dry air will make your skin feel uncomfortable. The travel agent assures you that almost daily "desert relative humidities are above 90 percent." Could the agent be correct? Explain your answer.

(3 marks)

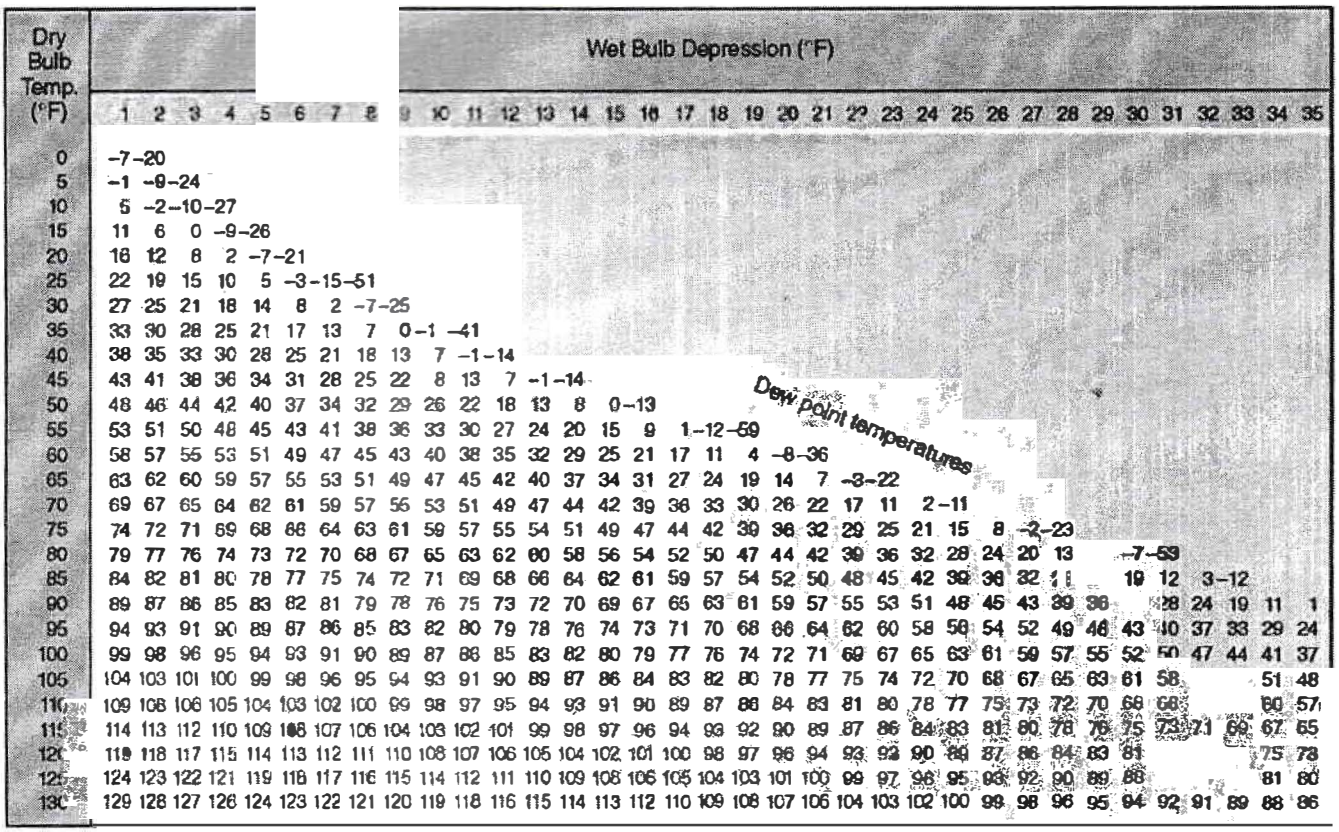
(d) The dry and wet bulb readings in Kandy are 80 °F and 69 °F. In Nuwara Eliya, the readings are 50 °F and 45 °F.

I. Use the following tables to determine the relative humidity and the dew point for both locations.

(2 marks)

II. Which of the **two locations** is more humid?

(1 mark)



Relative humidity values

Dry Bulb Temp. (°F)	Wet Bulb Depression (°F)																														
	1	2	3		5	6		8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
0	67	33	1																												
5	73	46	20																												
10	78		34	13																											
15	82		46	29	11																										
20	85	70	55	40	26	12																									
25	87	74	62	49	37	25	13	1																							
30	89	78	67	56	46	36	26	16	6																						
35	91	81	72	63	54	45	36	27	19	10	2																				
40	92	83	75	68	60	52	45	37	29	22	15	7																			
45	93	86	78	71	64	57	51	44	38	31	25	18	12	6																	
50	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5															
55	94	88	82	76	70	65	59	54	49	43	38	33	28	23	18	13	8	3													
60		95	90	85	80	75	70	66	61	56	52	48	44	39	35	31	27	24	20	16	12	9	5	2							
65		95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	15	12	9	6	3					
70		96	91	86	82	78	74	70	66	62	58	54	51	47	44	40	37	34	30	27	24	21	18	15	12	9	7	4	1		
75		96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	26	23	20	18	15	12	10	7	5	3
80		96	92	88	84	81	77	73	70	66	63	59	57	53	50	47	44	41	38	36	33	30	27	25	22	20	17	15	13	10	8
85		96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	34	31	29	26	24	22	19	17	15	13
90		96	93	89	86	82	79	76	73	69	66	63	61	58	55	52	50	47	44	42	39	37	34	32	30	28	25	23	21	19	17
95		96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	39	37	35	33	30	28	26	24	22	21
100		97	93	90	87	84	81	78	75	72	69	66	64	61	58	56	53	51	49	46	44	42	40	38	36	34	32	30	28	26	24
105		97	93	90	87	84	81	78	75	73	70	67	65	62	60	57	55	52	50	48	46	44	42	40	38	36	34	32	30	28	26
110		97	94	91	88	85	82	79	76	74	71	69	66	64	61	59	57	54	52	50	48	46	44	42	40	38	36	34	33	31	29
115		97	94	91	88	85	82	80	77	74	72	69	67	65	62	60	58	55	53	51	49	47	45	43	41	40	38	36	34	33	31
120		97	94	91	88	86	83	80	78	75	73	70	68	66	64	61	59	57	55	53	51	49	47	45	44	42	40	38	37	35	33
125		97	94	91	89	86	83	81	78	76	73	71	69	67	64	62	60	58	56	54	52	50	48	47	45	43	41	40	38	37	35
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4. (a) What determines the **terminal velocity** of falling droplets and raindrops?

(2 marks

(b) Explain why **radiation inversion** represents an **extremely stable atmosphere**.

(2 marks

(c) Describe the **four mechanisms** that lift air and promote cloud formation.

(4 marks

(d) With all other factors being equal, would you expect a *lower minimum temperature on a night with cirrus clouds* or on a *night with stratocumulus cloud*. Explain your answer.

(2 marks

Explain why atmospheric pressure always decreases with increasing altitude.

(2 marks

The **pressure gradient force** causes air to move from higher pressures toward

lower pressures (perpendicular to the isobars), yet actual winds rarely blow in this fashion. Explain this phenomenon.

(2 marks)

(c) Explain the concept of **hydrostatic equilibrium**.

(2 marks)

(d) Briefly describe the movement of air around **cyclones** and **anticyclones** in the Northern and Southern Hemispheres.

(2 marks)

(e) Suppose the average air density of the surface of a deep air column 1000 m thick is 1.1 kg/m^3, and the acceleration of gravity is 9.8 m/sec^2. Use the hydrostatic equation to determine the change in atmospheric pressure of the column (1 mb = 100 N/m^2).

(2 marks)

6. (a) Describe the various **scales of atmospheric motion**.

(3 marks)

(b) Describe **single-cell** and **three-cell** models of the general circulation.

(3 marks)

(c) Explain why cities near large bodies of cold water in summer experience well-developed sea breezes, but only poorly developed land breezes.

(2 marks)

(c) How does the polar front influence the development of the polar front jet stream?

(2 marks)

7. **(a)** How does pattern recognition aid a weather forecaster in making a prediction?

(2 marks)

(b) Do monthly and seasonal forecasts make specific predictions of rain or snow? Briefly explain your answer.

(2 marks)

(c) How do downdrafts form in thunderstorms?

(2 marks)

(d) Why does the bottom half of a dissipating thunderstorm usually **disappear** before the top?

(2 mar

(e) Sinking air warms, yet thunderstorm downdrafts are cold. Why?

(2 mar