Atmospheric Circulation and Weather Systems

Standard difficulty · 20 questions · 40 marks · Time: 37 minutes

Name: _____ Date: _____ Score: ____ / 40

Write full answers in Sections B and C. Answers are on the last page — try every question first!

Section A — Choose the correct answer — 8 × 1 = 8 marks

1. The average atmospheric pressure at sea level is about:
   (a) 540.5 mb **(b)** 265 mb **(c)** 898.8 mb **(d)** 1,013.2 mb

2. What are tropical cyclones called in the Atlantic?
   (a) hurricanes **(b)** waterspouts **(c)** tornadoes **(d)** willy-willies

3. Which air mass is coded “cT”?
   (a) continental polar **(b)** continental arctic
   (c) maritime tropical **(d)** continental tropical

4. What is an occluded front?
   (a) the front does not move
   (b) cold air moves towards warm air
   (c) an air mass is fully lifted above the surface
   (d) two air masses mix completely

5. What is a valley breeze?
   (a) cold air drains from plateaus and ice fields
   (b) cool air sinks into the valley at night
   (c) blows from land to sea at night
   (d) blows up the slopes by day

6. Where is the belt of the equatorial low found?
   (a) near the equator **(b)** along 45° N and S
   (c) about 60° N and S **(d)** near the poles

7. Near the ground, pressure falls about 1 mb for every 10 m. If the pressure at sea level is 1,000 mb, what is it at 950 m?
   (a) 905 mb **(b)** 895 mb **(c)** 1,095 mb **(d)** 915 mb

8. A tropical cyclone moves about 450 km a day. How many days will it take to travel 900 km to the coast?
   (a) 2 days **(b)** 3 days **(c)** 4 days **(d)** 5 days

Section B — Short answer — 8 × 2 = 16 marks

9. Name the three forces that affect the speed and direction of wind.

10. Do winds blow clockwise or anticlockwise around (a) a cyclone in the northern hemisphere (b) a cyclone in the southern hemisphere?

11. What is each? (a) an occluded front (b) a warm front

12. Describe each local wind: (a) a katabatic wind (b) a valley breeze

13. Name the air mass: (a) cP (b) cA

14. In the standard atmosphere the pressure is 1,013.25 mb at sea level and 540.48 mb at 5 km. By how much does it fall between them, and why does pressure fall with height?

15. Station A records 1,017 mb and station B, 200 km away, records 1,011 mb. What is the pressure gradient in mb per 100 km, and from which station will the wind blow?

16. Where is each pressure belt? (a) the equatorial low (b) the subpolar lows

Section C — Longer answers — 4 × 4 = 16 marks

17. Describe the world distribution of sea-level pressure.

18. Match each with its description: (a) a katabatic wind (b) a mountain wind (c) a land breeze. Choose from: cool air sinks into the valley at night; blows from land to sea at night; cold air drains from plateaus and ice fields.

19. A tropical cyclone over the Bay of Bengal moves about 450 km a day and is 2,250 km from the coast. (a) In how many days will it make landfall? (b) How far will it travel in 132 hours? (c) Why does it weaken over land?

20. Using a fall of 1 mb per 10 m near the ground, with 1,022 mb at sea level: (a) What is the pressure at 220 m? (b) At 430 m? (c) Why do we not feel strong upward winds despite this vertical pressure gradient?

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Answer key

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Q	Answer	Working
1	**(d) 1,013.2 mb**	—
2	**(a) hurricanes**	—
3	**(d) continental tropical**	—
4	**(c) an air mass is fully lifted above the surface**	—
5	**(d) blows up the slopes by day**	—
6	**(a) near the equator**	—
7	**(a) 905 mb**	950 ÷ 10 = 95; 1,000 − 95
8	**(a) 2 days**	900 ÷ 450
9	**The pressure gradient force, the frictional force and the Coriolis force.**	—
10	**(a) anticlockwise (b) clockwise**	—
11	**(a) an air mass is fully lifted above the surface (b) warm air moves towards cold air**	—
12	**(a) cold air drains from plateaus and ice fields (b) blows up the slopes by day**	—
13	**(a) continental polar (b) continental arctic**	—
14	**by 472.77 mb; there is less air above, and the air is rarer higher up.**	1,013.25 − 540.48
15	**3 mb per 100 km; from A (high pressure) towards B (low pressure)**	6 mb ÷ 2
16	**(a) near the equator (b) about 60° N and S**	—
17	**Equatorial low near the equator, subtropical highs near 30° N and S, subpolar lows near 60° N and S, and polar highs; the belts shift with the sun.**	—
18	**(a) cold air drains from plateaus and ice fields (b) cool air sinks into the valley at night (c) blows from land to sea at night**	—

Q	Answer	Working
19	**(a) 5 days (b) 2,475 km (c) Its supply of moisture, its source of energy, is cut off.**	2,250 ÷ 450; 450 × 5.5
20	**(a) 1,000 mb (b) 979 mb (c) The vertical pressure gradient is balanced by the nearly equal, opposite pull of gravity.**	1,022 − 22; 1,022 − 43