

Question 1

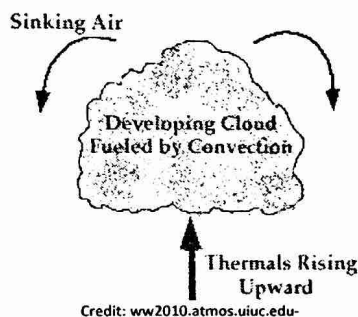
- (i) B (ii) C (iii) D (iv) C (v) A (vi) B (vii) B (viii) D (ix) B (x) E

Question 2

(a) The difference between weather and climate is that weather is a condition of the atmosphere at any moment, or its trend over a comparatively short period of time while climate is a mean condition of the atmosphere over a period of 30 years or so.

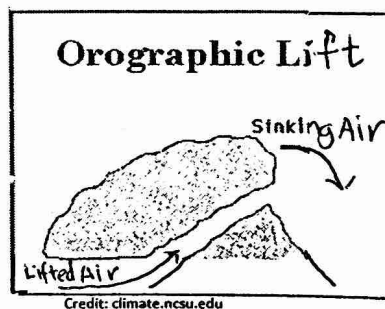
Factors that make up the weather are 1) Temperature 2) Pressure 3) Wind. Temperature difference creates pressure difference which drives wind. Wind move to equalize temperature to reduce the difference in pressure.

(b) Lifting by Convection

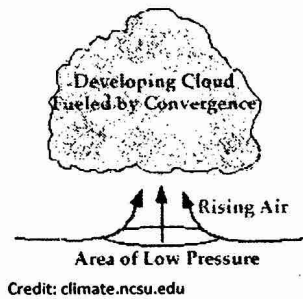


- Earth gets heater by Sun, forming bubbles of hot air (called thermals)
- Thermals rise upwards from the warm surface (because hot air is less dense), cooling as it rises and become diluted as it mixes with the surrounding air, thus losing buoyancy
- Cool air present aloft sinks and allows thermals to rise to an even greater height before losing their buoyancy.
- Successive thermals following the same path usually rise higher than previous ones, and if a thermal is able to rise high enough to cool to its saturation point, the moisture within condenses and becomes visible as a cloud.

Lifting due to topography (forming orographic clouds)

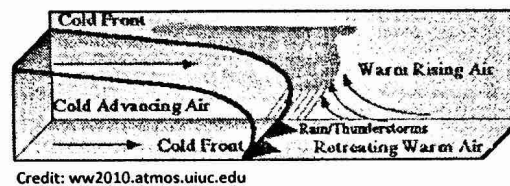


- When air is confronted by a mountain, it is lifted up and over the mountain, cooling as it rises.
- If the air is cools to its saturation point, the water vapour condenses and a cloud forms.



- Due to the area of low pressure, there is a horizontal net inflow of air into a region.
- When the air converges along the Earth's surface, it is forced to rise since it cannot go downward.
- When air is cooled to its saturation point, cloud is formed.

Lifting along a cold front

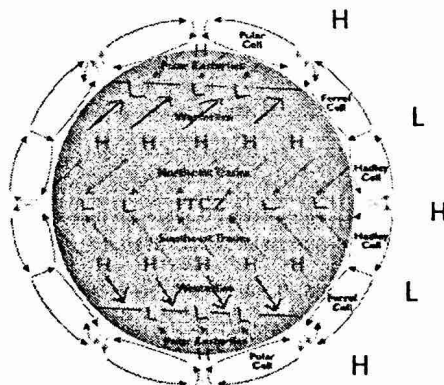


- A cold front, a colder, denser air mass lifts the warm, moist air ahead of it.
- As the air rises, it cools and its moisture condenses to produce clouds and precipitation.
- Due to the steep slope of a cold front, vigorous rising motion is often produced, leading to the development of showers and occasionally severe thunderstorms.

Note: Lifting along a warm front does not create a thunderstorm, thus not included in the answer.

Question 3

(a)



Earth also has bands of high pressure systems and bands of low pressure systems. It creates a horizontal flow at an altitude and near the surface of the Earth from H to L. From the Hadley cell, air mass from L flows down to H in a downward motion to replenish the air mass that flows from H to L at the surface of the Earth. Air mass flows from H to L at an altitude too. Thus air mass also flows from L to H in an upward motion to replenish the air at the altitude. Hence, due to the presence of the Hadley cell, Ferrel cell and polar cell, the trade wind is able to remain constant.

(b) This is due to the 23.5 degree tilt of the Earth. When the Earth tilts away from the Sun, solar angle is larger and thus more solar heating on the Southern Hemisphere. Furthermore, the heat is spread over a smaller area on the Southern hemisphere, thus there is more heat per unit area. The temperature will be higher, thus a lower pressure. Air will flow from a higher pressure area to a lower pressure area. Hence, a North West

monsoon over the Java sea. As the Earth rotates, it will tilt towards the Sun, solar angle is smaller and thus less solar heating on the Southern Hemisphere. Heat is spread over a larger area, thus less heat per unit area. The temperature will be lower, thus a higher pressure. Air flows from high to low pressure area. Hence, no more North – west monsoon over the Java Sea.

(ci) Tidal bore is a large wave caused by the constriction of the spring tide as it enters a long, narrow, shallow bay or harbour. They have a disturbing force due to gravity of the Moon and Earth while tsunami's disturbing force is due to seismic disruption and landslides. Tidal wave has a wavelength of half the circumference of Earth while tsunami has a wavelength of around 60-150m. Tidal waves are forced waves while tsunamis are free waves.

(cii) Flood current refers to tidal current caused by the rise in sea level as the tidal crest approaches the bay while ebb current refers to the current caused by a reduced in sea level.

Potential impact: affects the speed and position of the ship, difficult access to shallow ports.

Question 4

(ai) Wind strength, Wind duration and Fetch.

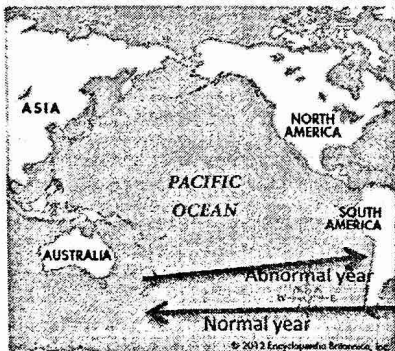
(aii) The wind strength in Singapore is not high due to large number of tall buildings around the river area. Furthermore, the surface wind is slowed down due to friction. Thus the speed of the wind near water is not high.

The fetch is short as the river is not long enough for the wind to blow over a long distance, thus a lower wave height.

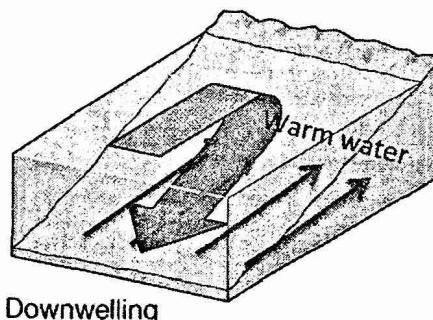
The river in Singapore is shallow. Thus there is a significant interaction (friction) with the bottom which slows down the waves, hence the wavelength also decreases. As a result, the energy per unit area of the wave has to increase so the wave height also increases. Once the 1: 7 ratio is breached, wave will break.

(bi) ENSO is El Nino Southern Oscillation. Surface wind normally moves from east to west (SE trade wind), from high pressure area near central and South America to the stable low pressure region north of Australia. However, these pressure areas will change places every 3-8 years. This result in the high pressure builds up in the western, and low in the eastern Pacific. Thus known as southern oscillation and is accompanied by a change in wind direction.

(bii) In a normal year, the trade winds drag large quantities of water westward along the ocean surface on both sides of the Equator. In an abnormal year, warm water at the western side of the Pacific flow east towards Central and South America and arrives near Peruvian coast. It caused nutrient depletion along the Peruvian coast due to cessation of upwelling, affecting fish population and sea bird migration pattern. Furthermore, water temperature also increases by up to 7 degree C, which results in more evaporation and intensifies coastal storms and increase inland rainfall.



Warm water



Credit: www.earthscienceeducation.org