| TEST CODE: | 7 | 4 | 0 | 8 | 1 | 0 | 7 | FIAS – GS Foundation 2024 \| Benchmark Assignment | #107 |
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# GS FOUNDATION PROGRAM 2024

***to be filled by the student:***

**BATCH: D6**

NAME: _____

ForumIAS Roll No: 19100 _____ Date: _ _ / _ _ / _ _ _ _ _ _ _ _

Email Id: _____ Mobile No. _ _ _ _ _ _ _ _ _ _

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**Feedbacks:**

| | Excellent | Very Good | Good | Average | Immediate Efforts/Improvement Required |
|---|---|---|---|---|---|
| Content | | | | | |
| Presentation | | | | | |
| Structure | | | | | |
| Consistency | | | | | |
| Revision/Recall | | | | | |

**Marks:**

| Subjective | Objective | Total |
|---|---|---|
| | | |

## Subjective Questions:

**Q.1) Tsunamis occur most frequently in the geologically most active fields of the earth. Explain factors responsible for occurrence of Tsunami and its effects on life and economy. (15 marks, 250 words)**

## Objective Questions:

**Q.1)** Consider the following conditions:
1. Presence of Coriolis force
2 A high humidity level in the middle troposphere.
3. Small variations in the vertical wind speed
4. Upper convergence above the sea level system
Which of the above conditions are favourable for formation and intensification of tropical cyclones?

- a) 1, 2 and 3 only
- b) 1 and 3 only
- c) 1, 3 and 4 only
- d) 1, 2, 3 and 4

**Q.2)** With reference to Cyclones, consider the following statements:
1. Bomb cyclone is named so because of the severe lightning and thunderstorms associated with it.
2. Temperate Cyclones move under the influence of the Westerlies.
3. Cyclonic winds circulate in anticlockwise direction in southern hemisphere.
Which of the statements given above is/are **incorrect**?

- a) 1 and 2 only
- b) 2 and 3 only
- c) 1 and 3 only
- d) 3 only

**Q.3)** Consider the following statements:
1. A sudden rise in the pressure of an area signals the approach of a cyclone
2. Anticyclone is characterised by clear sky and calm air.
Which of the statements given above is/ are correct?

- a) 1 only
- b) 2 only
- c) Both 1 and 2
- d) Neither 1 nor 2

**Q.4)** "This is a hot. dry dusty wind with a temperature of over 105°F which originates in the Sahara Desert. It blows outwards in a southerly direction from the desert interiors into the cooler Mediterranean Sea. Its scorching breath damages vegetation and crops."
Identify the local wind from the information given above and select the correct option:

- a) Fohn wind
- b) Sirocco wind
- c) Mistral wind
- d) Chinook wind

**Q.5)** Consider the following statements:
1. During the day time, sea becomes warmer leading to blowing of wind from the land to the sea.
2. During the night time, the slopes get cooled and the dense air descends into the valley as the mountain breeze.
Which of the following statements given above is/are correct?

- ☐ a) 1 only
- ☐ b) 2 only
- ☐ c) Both 1 and 2
- ☐ d) Neither 1 nor 2

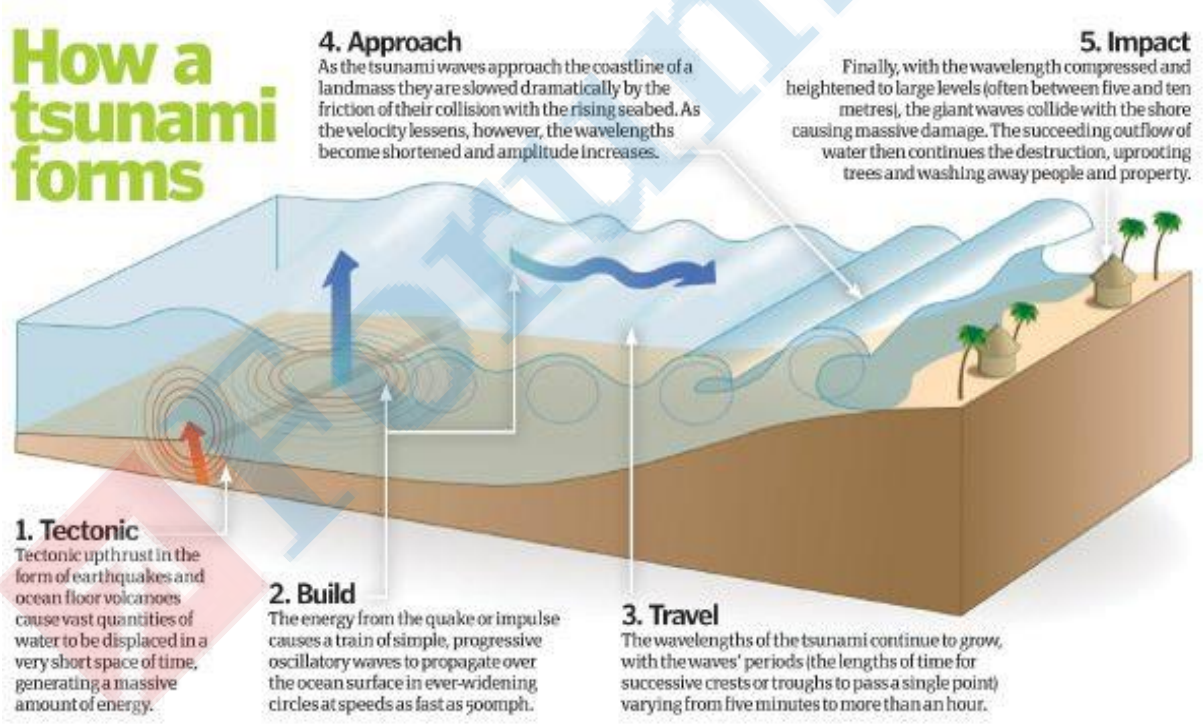
# GS Foundation Program 2024 | D6 | Benchmark Assignment #107

**Subjective Questions:**

**Q.1) Tsunamis occur most frequently in the geologically most active fields of the earth. Explain factors responsible for occurrence of Tsunami and its effects on life and economy.**

**Demand of the Question**
**Introduction**: Define tsunami, distribution
**Body**: Factors responsible, consequences- life, economy
**Conclusion**: Mention some measures as way forward

Tsunami waves are generated by events that displace of water. This displacement can be caused by movement of the ocean floor, by underwater (or at the shoreline) landslides or land slumps, volcanic activity, large releases of gases from the ocean floor, atmospheric pressure waves, by a large meteorite or asteroid plunging into the ocean. Tsunamis occur in the geologically most active fields of the earth like **Pacific ring of fire**. Globally, **70%** of the confirmed tsunami sources have been in the **Pacific Ocean**.




**FACTORS RESPONSIBLE FOR OCCURRENCE OF TSUNAMI**

1. **Earthquake**: Earth's surface is made up of a number of plates, they move relative to each other. At point of contact, mainly at **subduction**, due to earthquakes tsunami originates. For example in 2018: A 7.5 magnitude earthquake struck off the coast of Sulawesi, Indonesia, generating a tsunami that caused widespread devastation

2. **The Ring of fire:** Tsunamis happen most frequently in the Pacific Ocean because of the many large earthquakes associated with subduction zones along the margins of the Pacific Ocean basin, which is called the "Ring of Fire" (**90 %** of the world's earthquakes occur along the Ring of Fire)
3. **Volcanoes:** Volcanic activity can displace enough water to generate tsunamis. **Examples**: 1883: Indonesia Tsunami was caused by the **explosion of Krakatoa volcano,** 2022: A major explosive eruption from the **Hunga Tonga-Hunga Ha'apai volcano** in Tonga generated a tsunami that affected the entire Pacific Ocean basin.
4. **Landslides**: Involves rock slide, block slide, debris flows, avalanches and glacial calving which can cause tsunami. **Example**: **1998 Papua New Guinea Tsunami** was generated by a landslide.
5. **Nuclear Weapon or tests:** it's man-made disaster. Massive explosions created by a nuclear weapon of nuclear tests have the potential to cause tsunami.
6. **Meteotsunamis:** Air pressure disturbances often associated with fast moving weather systems, can displace bodies of water enough to generate Tsunamis.
   **Example**: 2013 New Jersey, USA Tsunami caused by a high-speed windstorm associated with thunderstorms
7. **Near Earth Objects:** Like an asteroid or comet to reach the earth and generate Tsunami

**EFFECTS OF TSUNAMI**

As tsunami releases enormous energy stored in them, it causes colossal loss of lives as well as the infrastructure of the place.

1. **Human resource:** The tsunami that struck northern Japan after an offshore earthquake on March 11, 2011, killed at least 14,340 people, which crushed buildings and left thousands trapped under debris or pulled out to sea.
2. **Psychological impact:** A study by the World Health Organization on survivors of the tsunami in Sri Lanka on December 24 2004 found that three to four weeks after the tsunami between 14 and 39% of the children had post-traumatic stress disorder (PTSD)
3. **Disease and contamination:** contaminated water and food supplies pose a risk to people's health, infectious diseases like Malaria and cholera may spread
4. **Destruction:** When the giant breaking waves of a tsunami batter the shoreline, they can destroy everything in their path. Especially along the **Ring of Fire**, tsunamis may have dramatic consequences as they hit less developed countries.
5. **Damage to economy:** Affects tourism, rebuilding after a tsunami puts a significant financial strain on governments as well, resulting in an economic downturn that can affect entire regions of the world.
6. **Adaptation cost:** Rebuilding cost, restoring of normalcy
7. **Impact on environment:** Landscapes that previously constituted picturesque beaches or seaside towns become a wasteland. Tsunamis destroy vegetation such as trees, resulting in landslides and coastlines that slip into the sea as deep root systems that previously held land in place get ripped out.

**MEASURES TO BE TAKEN**

1. **Tsunami Forecasting:** Using historical records and Plate tectonic theory occurrence of earthquake can be predicted. Tsunami waves behave in a predictable way. Sensors in the path of a tsunami can measure its characteristics.
2. **RIMES network:** The Regional Integrated Multi-Hazard Early Warning System (RIMES) is an intergovernmental institution owned and managed by its member states, for building capacities in the generation and application of user-relevant early warning. RIMES evolved from the efforts of countries in Africa, Asia and the Pacific, in the aftermath of the 2004 Indian Ocean tsunami, to establish a regional early warning system within a multi-hazard framework.
3. Strict implementation of the coastal regulation zone (CRZ norms).
4. Plantation of mangroves and coastal forests along the coastline
5. Community-based disaster risk reduction: Governments can work with communities to develop and implement disaster risk reduction plans. These plans can include measures such as early warning systems, hazard mapping, and community education.
6. Identification of vulnerable structures and appropriate retrofitting for tsunami resistance of all such buildings as well as appropriate planning, designing, construction of new facilities
7. Community-based disaster risk reduction: Governments can work with communities to develop and implement disaster risk reduction plans. These plans can include measures such as early warning systems, hazard mapping, and community education.
8. International cooperation: Governments can cooperate with each other to share information and resources to improve tsunami preparedness and response. This cooperation can take place through organizations such as the Intergovernmental Oceanographic Commission (IOC) of UNESCO and the Pacific Tsunami Warning Center (PTWC).

Tsunami is one of the most hazardous and unpredictable natural force. But what we can do is take necessary steps to minimize the damage caused by it. Tsunami is a global and transnational event. Hence, it is important that all countries across the world should join hands to evolve new scientific ways to predict Tsunamis and to design mitigations

**Additional info:**

**Mechanism of Tsunami waves:**

1. Tsunami waves are often generated along fault lines in the earth's crust, typically in areas where the continental and oceanic plates are in compression.
2. As a general rule, the continental plate rides over top of the oceanic plate. While the edges of both plates are engaged (not moving with respect to each other), the compressive forces that result from the overall plate movement causes tension to build up between the plates in the subduction zone.

3. Eventually the increasing pressure causes the edges of the plates disengage, allowing the plates to shift. The earthquake that results from the fracturing and subsequent movement of the plates may produce a tsunami.
4. Tsunami waves move rapidly across oceans one generated. The **speed and height of the tsunami wave depends on the depth of the ocean floor**. In areas of the Pacific where the ocean depth is 20,000 feet, tsunami waves are less than a foot high and move at speeds of about 550 mph - about the speed of a jet.
5. As the wave encounters shallower water the speed of a tsunami wave slows and the height increases. E.g., In about 300 feet of water, a tsunami wave will slow to about 60 mph and in 30 feet of water the wave will slow to 20 mph.
6. When a tsunami reaches shore, it may appear as a rapidly rising or falling tide, a series of breaking waves, or even a tidal bore. Reefs, bays, entrances to rivers, undersea features and the slope of the beach all help to modify the tsunami as it approaches the shore.

**Objective Questions:**

**Q.1)** Consider the following conditions:
1. Presence of Coriolis force
2 A high humidity level in the middle troposphere.
3. Small variations in the vertical wind speed
4. Upper convergence above the sea level system
Which of the above conditions are favourable for formation and intensification of tropical cyclones?

- ☐ a) 1, 2 and 3 only
- ☐ b) 1 and 3 only
- ☐ c) 1, 3 and 4 only
- ☐ d) 1, 2, 3 and 4

**Ans) a**

**Exp) Option a is correct**

Tropical cyclones originate and intensify over warm tropical oceans. The conditions favourable for the formation and intensification of tropical storms are:
1) Large sea surface with temperature higher than 27° C;
**2) Presence of the Coriolis force;**
3**) Small variations in the vertical wind speed;**
4) A pre-existing weak low-pressure area or low-level-cyclonic circulation;
**5) Upper divergence above the sea level system.**
6) **A high humidity level in the middle troposphere** from 3 to 6 km (1.8 to 3.7 miles) in height is more conducive to the production of deep cumulonimbus convection and therefore to stronger vertical coupling in the troposphere.

**Q.2)** With reference to Cyclones, consider the following statements:
1. Bomb cyclone is named so because of the severe lightning and thunderstorms associated with it.
2. Temperate Cyclones move under the influence of the Westerlies.
3. Cyclonic winds circulate in anticlockwise direction in southern hemisphere.
Which of the statements given above is/are **incorrect**?

- ☐ a) 1 and 2 only
- ☐ b) 2 and 3 only
- ☐ c) 1 and 3 only
- ☐ d) 3 only

**Ans) c**
**Exp) Option c is correct.**
**Statement 1 is incorrect:** If a storm is dubbed a bomb cyclone or "bombogenesis", to refer to a rapidly intensifying area of low pressure.
The term bombogenesis comes from the merging of two words: bomb and cyclogenesis. All storms are cyclones, and genesis means the creation or beginning. In this case, bomb refers to explosive development. Altogether the term means explosive storm strengthening.
**Statement 2 is correct:** Temperate Cyclones are depressions with low pressure at the centre. These are generally **steered by deep westerly winds** in a general west to east motion across both the Northern and Southern hemispheres of the Earth.
**Statement 3 is incorrect:** During a cyclone, winds blow inwards into regions of low pressure in the centre. Winds circulate in the anticlockwise direction in the northern hemisphere and clockwise in the southern hemisphere.

**Q.3)** Consider the following statements:
1. A sudden rise in the pressure of an area signals the approach of a cyclone
2. Anticyclone is characterised by clear sky and calm air.
Which of the statements given above is/ are correct?

- ☐ a) 1 only
- ☐ b) 2 only
- ☐ c) Both 1 and 2
- ☐ d) Neither 1 nor 2

**Ans) b**
**Exp) Option b is correct.**
**Statement 1 is incorrect –** Cyclones are depressions, they are areas with low pressure at the centre. The approach of the cyclone is characterised by a **fall in barometric reading (i.e. low pressure), dull sky, oppressive air and strong winds**.
**Statement 2 is correct –** Anticyclones are areas with high pressure centres. Pressure gradient is gentle and winds are light. They are characterized by **clear skies and calm air.** The temperature is high in summer and cool in winter.

**Q.4)** "This is a hot. dry dusty wind with a temperature of over 105°F which originates in the Sahara Desert. It blows outwards in a southerly direction from the desert interiors into the cooler Mediterranean Sea. Its scorching breath damages vegetation and crops."
Identify the local wind from the information given above and select the correct option:

- ☐ a) Fohn wind
- ☐ b) Sirocco wind
- ☐ c) Mistral wind
- ☐ d) Chinook wind

**Ans) b**
**Exp) Option b is correct.**
**Sirocco is a hot. dry dusty wind which originates in the Sahara Desert.** Though it may occur at any time of the year, it is most frequent in spring and normally lasts for only a few days. The Sirocco blows outwards in a southerly direction from the desert interiors into the cooler Mediterranean Sea. It is usually associated with depressions from the Atlantic passing from the coast eastwards inland. After crossing the Mediterranean Sea, the Sirocco is slightly cooled by the absorption of the water vapour. Even then, it is still hot and dry with a temperature of over 105°F. Its scorching breath withers vegetation and crops.
**Option a is Incorrect.** The Fohn wind is experienced in the valleys of the northern Alps, particularly in Switzerland in spring. It is dry winds experienced on the leeward side of mountains when descending air becomes compressed with increased pressure.
**Option c is Incorrect.** Mistral is a cold wind from the north, rushing down the Rhone valley in violent gusts between 40 and 80 miles per hour.In winter when the Mistral is most frequent the temperature of the wind may be below freezing-point, though the sky may be clear and cloudless.
**Option d is Incorrect.** On the eastern slopes of the Rockies in Canada and U.S.A. a local wind, similar to the Fohn in Switzerland, called the Chinook, comes in a south westerly direction to the Prairies and has a considerable effect on the local pastures.

**Q.5)** Consider the following statements:
1. During the day time, sea becomes warmer leading to blowing of wind from the land to the sea.
2. During the night time, the slopes get cooled and the dense air descends into the valley as the mountain breeze.
Which of the following statements given above is/are correct?

- ☐ a) 1 only
- ☐ b) 2 only
- ☐ c) Both 1 and 2
- ☐ d) Neither 1 nor 2

**Ans) b**
**Exp) Option b is correct.**
**Statement 1 is Incorrect**. D**uring the day the land heats up faster and becomes warmer than the sea.** Therefore, over the land the air rises giving rise to a low-pressure area, whereas the sea is relatively cool and the pressure over sea is relatively high. Thus, pressure gradient from sea to land is created and the wind blows from the sea to the land as the sea breeze.
**Statement 2 is correct.** During the night the slopes get cooled and the dense air descends into the valley as the mountain wind. The cool air, of the high plateaus and ice fields draining into the valley is called katabatic wind.