

Q. 1) Consider the following statements:

1. The features on the ocean floor are formed by the same factors like those of the continents.
2. Nearly 60% of the water that falls on the Earth gets evaporated eventually
3. Renewable water on the earth is moreover constant.

Which of the above statements is/are correct?

- a) Only 1 and 2
- b) Only 2 and 3
- c) Only 1
- d) 1, 2 and 3

Q.1) Solution: (d)

Explanation:

- The floors of the oceans are rugged with the world's largest mountain ranges, deepest trenches and the largest plains. These **features of the Ocean floor are formed by the tectonic, volcanic and depositional processes, just like those of the continents. Hence, statement 1 is correct.**
- About 71% of the planetary water is found in the oceans. The remaining is held as freshwater in glaciers and icecaps, groundwater sources, lakes, soil moisture, atmosphere, streams and within life. **Nearly 60% of the water that falls on land returns to the atmosphere through evaporation** from over the oceans as well as from other places. The remainder runs-off on the surface, infiltrates into the ground or a part of it becomes glacier. **Hence, statement 2 is correct.**
- **Renewable water on the earth is constant** while the demand is increasing tremendously. This leads to water crisis in different parts of the world – spatially and temporally. **Hence, statement 3 is correct.**

Q.2) Consider the following pairs regarding the ocean floor:

Sr.no.	Relief feature	Characteristics
1.	Continental shelf	Shallowest part of the ocean
2.	Deep-sea plain	Deepest part of the ocean
3.	Submarine canyons	Deep valleys found in continental slopes

How many pairs given above are correctly matched?

- a) One pair only
- b) Two pairs only
- c) All three pairs

d) None of the pairs

Q.2) Solution: (b)

Explanation:

- **Continental Shelf:** It is the extended margin of each continent occupied by relatively shallow seas and gulfs. It is the **shallowest part of the ocean** showing an average gradient of 1° or even less. The shelf typically ends at a very steep slope, called the shelf break. **Hence pair 1 is correctly matched.**
 - The width of the continental shelves varies from one ocean to another.
 - The average width of continental shelves is about 80 km.
 - The shelves are almost absent or very narrow along some of the margins like the coasts of Chile, the west coast of Sumatra, etc. On the contrary, the Siberian shelf in the Arctic Ocean, the largest in the world, stretches to 1,500 km in width.
 - The depth of the shelves also varies. It may be as shallow as 30 m in some areas while in some areas it is as deep as 600 m.
 - The continental shelves are covered with variable thicknesses of sediments brought down by rivers, glaciers, wind, from the land and distributed by waves and currents.
 - Massive sedimentary deposits received over a long time by the continental shelves become the source of fossil fuels.
- **Deep-Sea Plain:** Deep-sea plains are gently sloping areas of the ocean basins. These are the flattest and smoothest regions of the world. The depths vary between 3,000 and 6,000m. These plains are covered with fine-grained sediments like clay and silt.
 - **Trenches** are the deepest part of the oceans. **Hence pair 2 is not correctly matched.**
- **Submarine Canyons:** These are **deep valleys**, some comparable to the Grand Canyon of the Colorado river. They are sometimes found cutting **across the continental shelves and slopes**, often extending from the mouths of large rivers. The Hudson Canyon is the best-known submarine canyon in the world. **Hence pair 3 is correctly matched.**

Q.3) Which of the following statements about the Continental Shelf is correct?

- a) Continental shelves are occupied by relatively deep seas and abyssal plains.
- b) Continental shelves have fossil fuel reserves.
- c) Continental shelves indicate the centre of the continents.
- d) Trenches occur at the base of continental shelves.

Q.3) Solution: (b)

Explanation:

- **Continental Shelf:** It is the **extended margin(not centre) of each continent** occupied by **relatively shallow seas and gulfs**. It is the shallowest part of the ocean showing an average gradient of 1° or even less. While deep sea and Abyssal plains are in the deeper part of the ocean. Thus, **statement a and c are incorrect.**
- The shelf typically ends at a very steep slope, called the shelf break. It is the boundary that separates the shelf from the continental slope.
- Continental shelves contain valuable resources, such as oil and gas, and minerals. Oil and gas are formed from organic material that accumulates on the continental shelf. Over time the material is buried and transformed into oil and gas by heat and pressure.
- Continental shelves are home to the largest concentration of bottom-dwelling marine life, and they are the sites of major fishing grounds.
- Massive sedimentary deposits received over a long time by the continental shelves, become the source of fossil fuels. So, continental shelves have fossil fuel reserves. Thus, **Statement b is correct.**
- Trenches are the deepest parts of the oceans. The trenches are relatively steep-sided, narrow basins. They are some 3-5 km deeper than the surrounding ocean floor. **Trenches occur at the base of continental slopes** and along island arcs and are associated with active volcanoes and strong earthquakes. Thus, **statement d is incorrect.**

Q.4) Consider the following statements with respect to temperature distribution in the Oceans:

1. Temperature decreases uniformly with increasing depth in oceans
2. Enclosed seas record relatively higher temperature than the open seas in the lower latitudes.
3. The oceans in the northern hemisphere record relatively higher temperature than in the southern hemisphere.
4. The highest temperature of Oceans is not recorded at the equator.

How many of the above statements is/are correct?

- a) Only 1 statement is correct
- b) Only 2 statements are correct
- c) Only 3 statements are correct.
- d) All four statements are correct.

Q.4 Solution: (c)

Explanation:

- **Statement 1 is incorrect:** The maximum temperature of the oceans is always at their surfaces because they directly receive the heat from the sun and the heat is transmitted to the lower sections of the oceans through the process of conduction. There is a decline in the temperature with increasing depth, but the **rate of decrease is not uniform throughout**. The temperature falls very rapidly up to the depth of 200 m and thereafter, the rate of decrease of temperature is slowed down.
- **Statement 2 is correct:** In the low latitudes, the enclosed seas record relatively higher temperature than the open seas while in the high latitudes, the enclosed seas record relatively lower temperature than the open seas.
- Temperature structure of oceans can be described as three-layer system. First layer (Top layer) is about 500m thick with temperatures ranging between 20 to 25 °C. Second layer (Thermocline) is characterized by rapid decrease in temperature with increasing depth. It is about 500m-1000m thick. Third layer is very cold and extends upto deep ocean floor. Here temperature change with the depth is very slight.
- The average temperature of surface water of the oceans is about 27°C and it gradually decreases from the equator towards the poles. **The highest temperature is not recorded at the equator** but slightly towards north of it. Thus, **Statement 4 is correct**.
- **The oceans in the northern hemisphere record relatively higher temperature than in the southern hemisphere.** The average annual temperatures for the northern and southern hemisphere are around 19° C and 16° C respectively. This variation is due to the unequal distribution of land and water in the northern and southern hemispheres. Thus, **statement 3 is correct**.

Q.5 Which of the following statements about the thermocline in the ocean is *incorrect*?

- It is a layer of ocean characterized by the rapid decrease in temperature and salinity with decreasing depth.
- In the thermocline zone, temperatures approach 0° C.
- About 90% of the total volume of water is found below the thermocline.
- Thermocline is more pronounced in the lower latitudes.

Q. 5 Solution: (a)

Explanation:

- The temperature structure of oceans over middle and low latitudes can be described as a three-layer system from the surface to the bottom.
 - The first layer represents the top layer of warm oceanic water and it is about 500m thick with temperatures ranging between 20° and 25° C. This layer, within

the tropical region, is present throughout the year but in mid-latitudes, it develops only during summer.

- The second layer called the thermocline layer lies below the first layer and is characterized by the **rapid decrease in temperature with increasing depth**. The thermocline is 500 -1,000 m thick. About **90% of the total volume of water is found below the thermocline** in the deep ocean. In this zone, **temperatures approach 0°C**. Thus, **statements b and c are correct**.
- **Statement a is incorrect as thermocline is not associated with salinity**. Also, salinity increases with depth.
- The third layer is very cold and extends up to the deep ocean floor. In the Arctic and Antarctic circles, the surface water temperatures are close to 0° C and so the temperature change with the depth is very slight. Here, only one layer of cold water exists, which extends from the surface to the deep ocean floor.
- **Statement d is correct:** Temperature profiles vary at different latitudes, as the surface water is warmer near the equator and colder at the poles. In **low latitude tropical region, the sea surface is much warmer, leading to a highly pronounced thermocline**.

Q. 6 Which of the following factors affect salinity of Oceans directly?

1. Freezing and thawing of polar ice
2. Coriolis force
3. Rainfall
4. Wind
5. Ocean currents

Select the correct option from the codes given below:

- a) Only 1, 2 and 3
- b) All of the above
- c) Only 2, 4 and 5
- d) 1, 3, 4 and 5

Q.6 Solutions: (d)

Explanation:

Factors affecting ocean salinity are mentioned below:

- i. The salinity of water in the surface layer of oceans depend mainly on **evaporation and precipitation**.
- ii. Surface salinity is greatly influenced in coastal regions by the **fresh water flow from rivers**, and in polar regions by the processes of **freezing and thawing of ice**.

- iii. **Wind**, also influences salinity of an area by transferring water to other areas.
- iv. The **ocean currents** contribute to the salinity variations.
- v. Salinity, temperature and density of water are interrelated. Hence, any **change in the temperature or density** influences the salinity of water in an area.
- **Coriolis force does not affect the salinity of oceanic water directly. However it can have an indirect effect as it influences the flow of ocean currents. Hence option 2 is incorrect and other all are correct.**

Q.7) Consider the following statements:

1. Salinity increases from the equator towards the poles due to reduction in rainfall.
2. Salinity increases with depth up to the region of halocline where the salinity drops sharply.
3. The Bay of Bengal has greater salinity than the Arabian Sea due to its vast expanse leading to higher evaporation of water.

How many of the above statements is/are correct?

- a) Only 1 statement is correct.
- b) Only 2 statements are correct.
- c) Only 3 statements are correct.
- d) None of the statements are correct.

Q.7 Solution: (d)

Explanation:

- **Statement 1 is incorrect:** On an average, **salinity decreases from equator towards the poles**. However, it is important to note that the highest salinity is seldom recorded near the equator. It is at a minimum near the Equator, reaches a maximum in about latitudes 20°N and 20°S, and again decreases toward high latitudes.
- The equator receives the most rain on a consistent basis. As a result, the freshwater falling into the ocean helps decrease the salinity of the surface water in that region. Hence salinity is lower than the average 35 ppt (parts per thousand) in equatorial waters. The highest salinity is recorded between 15° and 20° latitudes. Maximum salinity (37 ppt) is observed between 20° N and 30° N and 20° W - 60° W. It gradually decreases towards the north.
- **Statement 2 is incorrect:** Salinity, generally, increases with depth and there is a distinct zone called the halocline, where salinity increases sharply. Other factors being constant,

increasing the salinity of seawater causes its density to increase. High salinity seawater, generally, sinks below the lower salinity water. This leads to stratification by salinity.

- **Statement 3 is incorrect:** The average salinity of the Indian Ocean is 35ppt. **The Bay of Bengal is relatively less saline than the Arabian Sea.** The low salinity trend is observed in the Bay of Bengal due to the influx of river water by the river Ganga. On the contrary, the Arabian Sea shows higher salinity due to high evaporation and a low influx of freshwater.

Q. 8) With reference to the horizontal distribution of salinity in seas and oceans, which of the following statements is correct?

- The Mediterranean Sea records lower salinity due to large influx of fresh water from multiple large rivers.
- The North Sea has lower salinity because it is located in higher latitudes.
- The Black Sea records very low salinity in comparison to the Red Sea due to fresh water influx by rivers.
- The Baltic Sea records high salinity due to more saline water brought by the North Atlantic Drift.

Q. 8 Solution: (c)

Explanation:

HORIZONTAL DISTRIBUTION OF SALINITY

- The salinity for normal open ocean ranges between 33 ppt and 37 ppt. In the land locked Red Sea, it is as high as 41 ppt, while in the estuaries and the Arctic, the salinity fluctuates from 0 - 35 ppt, seasonally. In hot and dry regions, where evaporation is high, the salinity sometimes reaches to 70 ppt.
- The salinity variation in the Pacific Ocean is mainly due to its shape and larger areal extent. Salinity decreases from 35 ppt - 31 ppt on the western parts of the northern hemisphere because of the influx of melted water from the Arctic region.
- In the same way, after 15° - 20° south, it decreases to 33 ppt. The average salinity of the Atlantic Ocean is around 36 ppt. The highest salinity is recorded between 15° and 20° latitudes. Maximum salinity (37 ppt) is observed between 20° N and 30° N and 20° W - 60° W. It gradually decreases towards the north.
- The North Sea, in spite of its location in higher latitudes, records higher salinity due to more saline water brought by the North Atlantic Drift. Thus, **statement (b) is incorrect.**
- Baltic Sea records low salinity due to influx of river waters in large quantity. Thus, **statement (d) is incorrect.**

- The Mediterranean Sea records higher salinity due to high evaporation. So, **statement (a) is incorrect.**
- Salinity is, however, very low in Black Sea due to enormous fresh water influx by rivers. So, **statement (c) is correct.**
- The average salinity of the Indian Ocean is 35 ppt. The low salinity trend is observed in the Bay of Bengal due to influx of river water. On the contrary, the Arabian Sea shows higher salinity due to high evaporation and low influx of fresh water.

Q.9) Consider the following statements with respect to the difference between waves and ocean currents:

1. Ocean currents refers to horizontal motion of water while waves refer to vertical motion of water.
2. Water moves through ocean currents while water in the waves does not move ahead.

Which of the above statements is/are correct?

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

Q.9) Solution: (b)

Explanation:

- The ocean water is dynamic. Its physical characteristics like temperature, salinity, density and the external forces like of the sun, moon and the winds influence the movement of ocean water.
- The horizontal motion refers to the ocean currents and waves. Thus, both ocean currents and waves are horizontal motion. While tide is vertical motion. **Hence, statement 1 is incorrect.**
- Ocean currents are the continuous flow of huge amount of water in a definite direction while the waves are the horizontal motion of water.
- **Water moves ahead** from one place to another **through ocean currents** while the **water in the waves does not move ahead**, but the wave trains move ahead. So, **statement 2 is correct.**
- The vertical motion is called tides and refers to the rise and fall of water in the oceans and seas. Due to attraction of the sun and the moon, the ocean water is raised up and

falls down twice a day. The upwelling of cold water from subsurface and the sinking of surface water are also forms of vertical motion of ocean water.

Q. 10) Which of the statements given below about waves is *incorrect*?

- a) Waves are energy that moves through the ocean waters because of wind.
- b) In waves, the water does not move ahead.
- c) The motion of the surface water in waves is seen as the vertical motion of ocean water.
- d) The largest waves are found in the open oceans.

Q. 10) Solution: (c)

Explanation:

- **Statement (a) is correct: Waves are actually the energy, not the water** as such, which moves across the ocean surface. Water particles only travel in a small circle as a wave passes. **Wind provides energy** to the waves. Wind causes waves to travel in the ocean and the energy is released on shorelines. The motion of the surface water seldom affects the stagnant deep bottom water of the oceans. As a wave approaches the beach, it slows down.
- This is due to the friction occurring between the dynamic water and the sea floor. And, when the depth of water is less than half the wavelength of the wave, the wave breaks. **The largest waves are found in the open oceans.** Waves continue to grow larger as they move and absorb energy from the wind. Thus, **statement (d) is correct.**
- **Statement (b) is correct:** The **water in the waves does not move**, but the wave trains move ahead. The actual motion of the water beneath the waves is circular.
- **Statement (c) is incorrect:** The ocean water is dynamic. Both ocean currents and waves are horizontal motion of oceanic water.
- Most of the waves are caused by the wind driving against water. When a breeze of two knots or less blows over calm water, small ripples form and grow as the wind speed increases until white caps appear in the breaking waves. Waves may travel thousands of km before rolling ashore, breaking and dissolving as surf.
- A wave's size and shape reveal its origin. Steep waves are fairly young ones and are probably formed by local wind. Slow and steady waves originate from faraway places, possibly from another hemisphere. The maximum wave height is determined by the strength of the wind, i.e., how long it blows and the area over which it blows in a single direction.
- Waves travel because wind pushes the water body in its course while gravity pulls the crests of the waves downward. The falling water pushes the former troughs upward, and the wave moves to a new position. The actual motion of the water beneath the waves is circular. It indicates that things are carried up and forward as the wave approaches, and down and back as it passes.

Q.11) Consider the following statements with respect to tides:

1. The Moon's gravitational pull has a greater role than the Sun's, in shaping the tides.
2. The 'tide-generating' force is the difference between these two forces; i.e., the gravitational attraction of the moon and the sun.

Which of the above statements are correct?

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

Q.11) Solution: (a)

Explanation:

- The periodical rise and fall of the sea level, once or twice a day, mainly due to the attraction of the sun and the moon, is called a *tide*.
- The study of tides is very complex, spatially and temporally, as it has great variations in frequency, magnitude and height.
- **Statement 1 is correct:** The moon's gravitational pull to a great extent and to a lesser extent the sun's gravitational pull, are the major causes for the occurrence of tides. Another factor is centrifugal force, which is the force that acts to counter balance the gravity.
- The '**tide-generating' force is the difference between these two forces; i.e., the gravitational attraction of the moon and the centrifugal force.** Hence, **statement 2 is incorrect.**
- On the surface of the earth, nearest the moon, pull or the attractive force of the moon is greater than the centrifugal force, and so there is a net force causing a bulge towards the moon.
- On the opposite side of the earth, the attractive force is less, as it is farther away from the moon, the centrifugal force is dominant. Hence, there is a net force away from the moon. It creates the second bulge away from the moon.
- On the surface of the earth, the horizontal tide generating forces are more important than the vertical forces in generating the tidal bulges.
- The tidal bulges on wide continental shelves, have greater height. When tidal bulges hit the mid-oceanic islands, they become low. The shape of bays and estuaries along a coastline can also magnify the intensity of tides.
- Tides originate in the ocean and progress toward the coastlines where they appear as the regular rise and fall of the sea surface. When the highest part, or crest, of the wave

reaches a particular location, high tide occurs; low tide corresponds to the lowest part of the wave, or its trough. The difference in height between the high tide and the low tide is called the tidal range.

Q.12) Consider the following statements regarding neap tides:

1. The Sun and the moon are at right angle to each other during neap tide.
2. The Moon's gravitational pull is diminished during neap tide.
3. A neap tide happens between two spring tides and occurs twice a month.
4. Neap tides are higher and stronger than spring tides.

How many of the statements given above are correct?

- a) Only 1 statement is correct
- b) Only 2 statements are correct.
- c) Only 3 statements are correct.
- d) All 4 statements are correct.

Q. 12) Solution: (c)

Explanation:

Tides refer to the rise and fall of a body of water caused by the interaction between the moon, sun, and Earth.

- The height of rising water (high tide) varies appreciably depending upon the position of sun and moon with respect to the earth. There are two main tides that are higher or lower than average. They are called spring and neap tides respectively.
 - *Spring tides*: When the sun, the moon and the earth are in a straight line, the height of the tide will be higher. These are called spring tides and they occur twice a month, one on full moon period and another during new moon period.
 - *Neap tides*: At this time the **sun and moon are at right angles** to each other and the forces of the sun and moon tend to counteract one another. Thus, the **neap tide would be lower and weaker than the spring tides**. The **Moon's attraction**, though more than twice as strong as the sun's, is **diminished by the counteracting force** of the sun's gravitational pull. Hence, **statements 1 and 2 are correct while statement 4 is incorrect**.
- Normally, there is a seven-day interval between the spring tides and neap tides. Thus, there would be **spring and neap tides twice every month** and there would be **one neap tide between two spring tides** and vice-versa. Hence, **statement 3 is correct**.

Q.13) Consider the following statements with respect to Ocean currents:

1. The ocean currents are strongest at the surface and decrease in strength with depth.
2. Near the equator, the ocean water is lower than the middle latitudes and this is a primary factor which gives rise to oceanic currents.

Which of the above statements is/are correct?

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

Q.13) Solution: (a)

Explanation:

- Ocean currents are like river flow in oceans. They represent a regular volume of water in a definite path and direction. Ocean currents are influenced by two types of forces namely
 - primary forces that initiate the movement of water
 - secondary forces that influence the currents to flow.
- The **primary forces** that influence the currents are:
 - **Heating by solar energy:** Heating by solar energy causes the water to expand. That is why, **near the equator the ocean water is about 8 cm higher in level than in the middle latitudes.** This causes a very slight gradient and water tends to flow down the slope. Thus, **statement 2 is incorrect.**
 - **Wind:** Wind blowing on the surface of the ocean pushes the water to move. Friction between the wind and the water surface affects the movement of the water body in its course.
 - **Gravity:** Gravity tends to pull the water down to pile and create gradient variation.
 - **Coriolis force:** The Coriolis force intervenes and causes the water to move to the right in the northern hemisphere and to the left in the southern hemisphere. These large accumulations of water and the flow around them are called Gyres. These produce large circular currents in all the ocean basins.
- **Differences in water density** affect vertical mobility of ocean currents. Water with high salinity is denser than water with low salinity and in the same way cold water is denser than warm water. Denser water tends to sink, while relatively lighter water tends to rise.

- Cold-water ocean currents occur when the cold water at the poles sinks and slowly moves towards the equator. Warm-water currents travel out from the equator along the surface, flowing towards the poles to replace the sinking cold water.
- The topography and shape of ocean basins and nearby landmasses also influence ocean currents.
- Currents are referred to by their “drift” i.e., the speed of a current. **A current is usually strongest at the surface** and decreases in strength (speed) with depth. Usually, the currents near the surface may attain speeds over 5 knots while at depths, currents are generally slow with speeds less than 0.5 knots. Hence, **statement 1 is correct.**

Q. 14) This current is part of the Atlantic Ocean. It flows in the clockwise direction bordering Africa. It is a cold current and forms the Sargasso Sea. It eventually joins the Atlantic North Equatorial Current.

The above description best suits which of the following currents?

- a) Irminger current
- b) Benguela current
- c) Gulf current
- d) Canary Current

Q.14) Solution: (d)

Explanation:

- Canary Current, also called Canaries Current, part of a clockwise-setting ocean-current system in the North Atlantic Ocean.
- The Canary Current is part of the North Atlantic Gyre and forms the eastern part of the Sargasso Sea.
- It branches south from the North Atlantic Current and flows southwestward along the northwest coast of Africa as far south as Senegal before turning westward to eventually join the Atlantic North Equatorial Current.
- It is a cold current. The cool temperature of the water is produced by upwelling caused by offshore winds from the continent.
- As the current flows around the Canary Islands, it helps to lessen the heating effect of the Sahara to the east. The thermal mixing creates excellent fishing grounds in the region.



Q.15) Which of the following is the odd one among the list of currents given below:

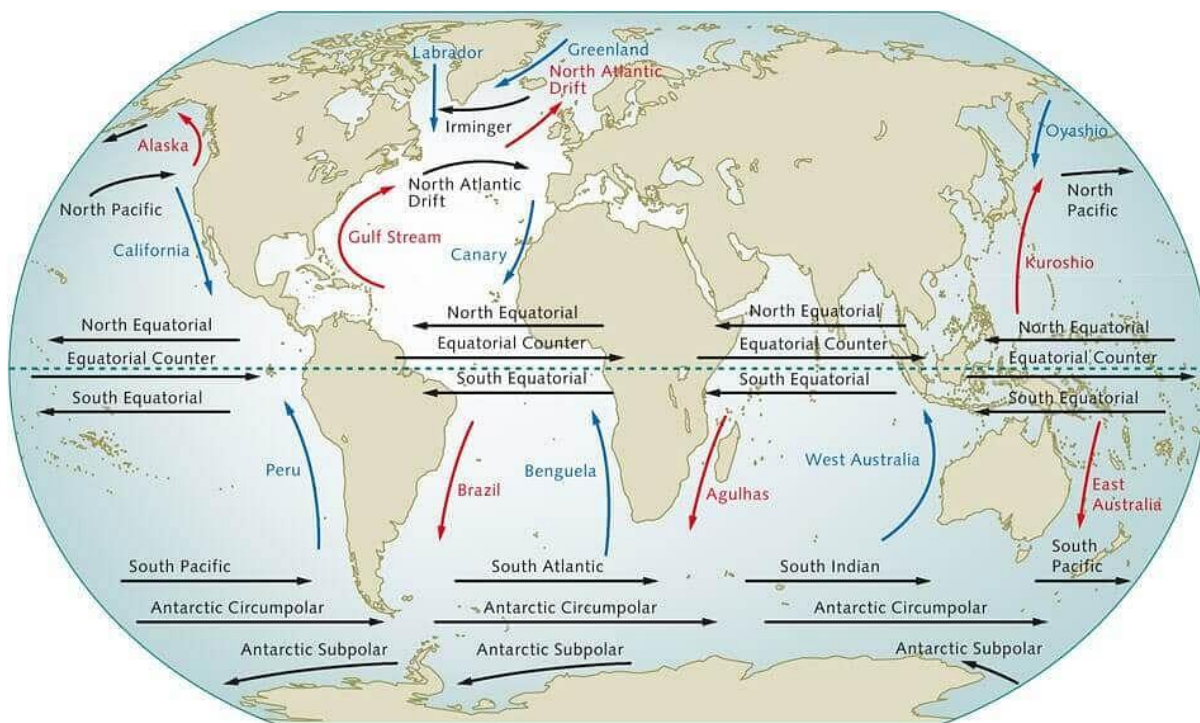
- Kuroshio current
- Oyashio current
- Irminger current
- Peru current

Q.15) Solution: (c)

Explanation:

- **Except Irminger, all others are part of the Pacific Ocean Currents.** It includes various cold and warm current which moves clockwise circulation in the Northern Pacific Ocean and Anticlockwise circulation in South Pacific Ocean thereby influencing the climatic pattern in the coastal regions.
- The currents are mentioned below:
 - North Equatorial Current (Warm)
 - South Equatorial Current (Warm)
 - Counter Equatorial Current (Warm)
 - Kuroshio System (Warm)
 - North Pacific Drift (Warm)
 - Oyashio Current (Cold)
 - California Current (Cold)
 - Peruvian or Humboldt Current (Cold)
 - East Australia Current (Warm)
 - Alaska current (warm)

- Irminger Current is a branch of the **warm North Atlantic Current**, flowing generally westward along the south coast of Iceland. The Irminger Current is a rather saline flow that represents a combination of waters from the North Atlantic and the Arctic oceans.



Q.16) Match the following pairs:

Sr.no.	Ocean currents	Oceans
1.	Gulf Stream	Atlantic Ocean
2.	Benguela Current	Indian Ocean
3.	Agulhas Current	Pacific Ocean
4.	Humboldt Current	Pacific Ocean

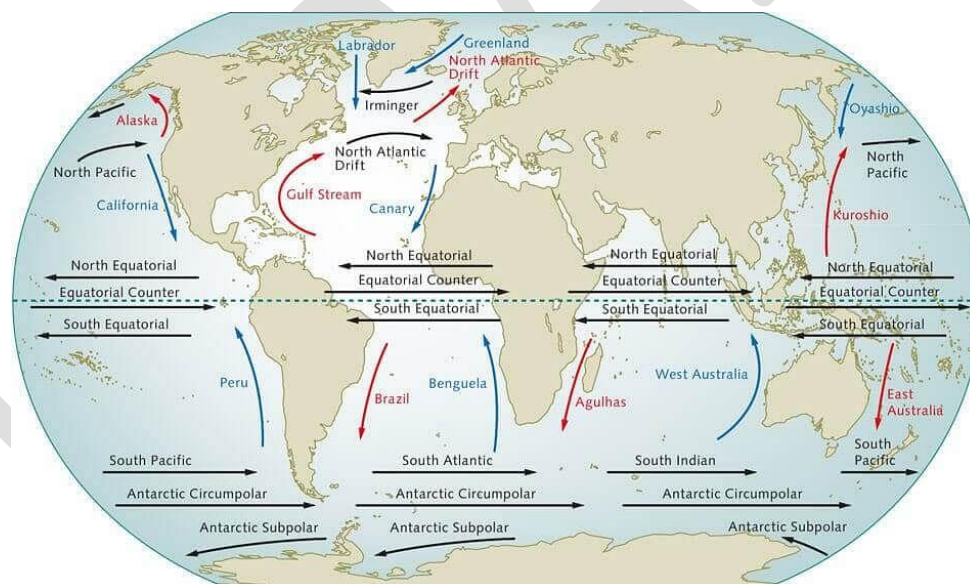
How many pairs given above are correctly matched?

- One pair only
- Two pairs only
- Three pairs only
- All four pairs

Q. 16) Solution: (b)

Explanation:

- **Gulf Stream:** It is a **warm-ocean current** flowing in the **North Atlantic** northeastward off the North American coast. In popular conception the Gulf Stream also includes the Florida Current.
- **Benguela Current:** It is a branch of the **West Wind Drift** of the Southern Hemisphere. It flows northward in the **South Atlantic Ocean** along the west coast of southern Africa nearly to the Equator before merging with the westward-flowing Atlantic South Equatorial Current.
- **Agulhas Current:** It forms the western boundary current of the **southern Indian Ocean**. It is a warm current that flows southward along the southeast coast of Mozambique and the coast of South Africa before turning eastward to join the West Wind Drift flowing from Africa to Australia. The Mozambique Current, between Madagascar and Africa, also feeds the Agulhas Current.
- **Humboldt Current, also called as Peru Current,** is a **cold-water current** of the **southeast Pacific Ocean**. It is an eastern boundary current similar to the California Current of the North Pacific. As it is a cold current, except at times of El Niño, the Peru Current brings fog to the nearby coast but also helps to keep the coast one of the most intensely arid areas in the world.



Q. 17) Consider the following statements regarding the Atlantic Meridional Overturning Circulation (AMOC):

1. It is a large system of surface ocean currents that carry warm water from the tropics northwards into the North Atlantic.
2. It is a part of the thermohaline circulation.
3. Increase in the temperature of the Indian Ocean helps strengthen the AMOC.

Which of the statements given above is/are correct?

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

Q.17) Solution: (d)

Explanation:

- The Atlantic Meridional Overturning Circulation (AMOC) is a large system of deep-ocean currents (not surface currents) that carry warm water from the tropics northwards into the North Atlantic. Hence, **statement 1 is incorrect.**
- Winds drive ocean currents in the upper 100 meters of the ocean's surface. However, ocean currents also flow thousands of meters below the surface. These deep-ocean currents are driven by differences in the water's density, which is controlled by temperature (thermo) and salinity (haline). This process is known as **thermohaline circulation**. The thermohaline circulation is sometimes called the ocean conveyor belt.
- The **AMOC is a part of the thermohaline circulation**. Hence, **statement 2 is correct**. As warm water flows northwards it cools and some evaporation occurs, which increases the amount of salt. Low temperatures and a high salt content make the water denser, and this dense water sinks deep into the ocean. The cold, dense water slowly spreads southwards, several kilometers below the surface. Eventually, it gets pulled back to the surface and warms in a process called "upwelling" and the circulation is complete.
- It helps in the distribution of heat and energy around the earth by ensuring mixing of the oceans. This, in turn, contributes to the climate we experience today.
- Climate models suggest that the AMOC will weaken over the 21st Century as greenhouse gases increase. This is because as the atmosphere warms, the surface ocean beneath it retains more of its heat. Meanwhile, increases in rainfall and ice melt mean it gets fresher too. All these changes make the ocean water lighter and so reduce the sinking in the 'conveyor belt', leading to a weaker AMOC. So the AMOC is very likely to weaken, but large, rapid changes in the AMOC are not expected in the 21st century.
- Researchers say that **warming of the Indian Ocean will strengthen the weakening AMOC**. Hence, **statement 3 is correct.**

- Warming in the Indian Ocean generates additional precipitation by drawing more air from other parts of the world, including the Atlantic.
- The higher level of precipitation in the Indian Ocean will reduce precipitation in the Atlantic and increase salinity in the waters.
- This saline water in the Atlantic, as it comes north via AMOC, will get cold much quicker than usual and sink faster, acting as a jump start for AMOC by intensifying the circulation.

Q. 18) Consider the following statements:

1. Corals are found even beyond the tropical warm waters.
2. Not all corals have a symbiotic relationship with the zooxanthellae.
3. Corals do not exist in the deep ocean beyond 200 meters.
4. The corals in the tropics are the most extensive ones due to the availability of ideal conditions for their growth.

How many of the above statements is/are correct?

- a) Only 1 statement is correct.
- b) Only 2 statements are correct.
- c) Only 3 statements are correct.
- d) All 4 statements are correct.

Q.18) Solution: (b)

Explanation:

- Researchers are now discovering deep-sea coral reefs in many of the world's seas and oceans, including the Atlantic, Pacific, Indian Ocean and the Mediterranean.
- Because they don't depend on warm water or sunlight, deep-sea corals are able to live in many different places around the world. In fact, **over half of all known coral species are found in cold, deep, and dark waters. Thus, statement 1 is correct.**
- Like shallow-water corals, deep-sea corals may exist as individual coral polyps, as diversely-shaped colonies containing many polyps of the same species, and as reefs with many colonies made up of one or more species.
- Unlike shallow-water corals, however, deep-sea corals don't need sunlight. They **obtain the energy and nutrients they need to survive by trapping tiny organisms in passing currents.** The deep-sea corals exist in a world of darkness and **lack the symbiotic association with the algae (called zooxanthellae)** that populate the shallow corals. Thus, **statement 2 is correct.**

- Living in waters of **4-13°C**, they are usually found in **depths between 200 and 1,000 metres**. However, they can occur as shallow as 40 metres and as deep as 6,300 metres. Thus, **statement 3 is incorrect**.
- Some individual **cold-coral reefs** on the continental shelves of the East Atlantic stretching from Norway as far south as West Africa, are, when combined, **far bigger than more famous tropical ones** such as Australia's Great Barrier Reef. Thus, **statement 4 is incorrect**.

Q. 19) Baltoro, Biafo and Zemu are names associated with:

- a) Rivers
- b) Glaciers
- c) Lakes
- d) Deserts

Q. 19) Solution: (b)

Explanation:

- All of the above are glaciers present in the Himalayas.
- India is home to a large number of glaciers. As per a study conducted by the Space Applications Centre, Indian Space Research Organisation (ISRO), India has 16,627 glaciers. The Himalayan region, in particular, has some of the most prominent glaciers in the world.
- **Siachen Glacier:** It is the largest glacier in India, found in the Karakoram range in the Himalayas.
- **Gangotri Glacier:** It is the second biggest glacier in India and is located in Uttarkashi District, Uttarakhand, India, in a region bordering Tibet. It is the source of the This glacier is a prominent source of the river Ganga.
- **Zemu Glacier:** It is present in the Eastern Himalayas and is located at the base of Kangchenjunga. The glacier is the water source for multiple rivers like the Teesta and Zemu River.
- **Baltoro and Biafo** are glaciers in the Karakoram ranges.

Q. 20) Which of the following statements best describes "Artesian basin"?

- a) It is a region where groundwater is cramped under pressure between layers of rock.

- b) It is a region where cold current and warm current meet to form some of the best fishing areas.
- c) It is the region in large continental shelves where fossil fuels are found in abundance.
- d) It is a swamp region which is permanently inundated by water.

Q. 20) Solution: (a)

Explanation:

- An artesian basin is a **low-lying region where groundwater is cramped under pressure** from surrounding layers of rock. These basins are usually found where an aquifer is present in a syncline, by impenetrable layers above as well as below.
- Whenever a fissure breaks the surface, the underground water blows up. This results in the rising of the water level to the point where hydrostatic equilibrium is attained.
- For an aquifer to be artesian, the water table must reach the surface.
- The Great Artesian Basin is the largest artesian basin in the world and one of the largest underground freshwater resources in the world. It is located within Australia.

Q.21) Consider the following statements with respect to 'Pradhan Mantri Surakshit Matritva Abhiyan programme (PMSMA)'

1. The scheme has been launched by the Ministry of Health and Family Welfare.
2. The scheme identifies and follows-up on high risk pregnancies by adding red stickers to the Mother and Child Protection cards of women.
3. The program aims to provide assured comprehensive and quality antenatal care free of cost universally to all pregnant women at all Ayushman Bharat empanelled hospitals.

Choose the correct statements:

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

Q.21) Solution (a)

Explanation:

- The **Pradhan Mantri Surakshit Matritva Abhiyan** has been launched by the **Ministry of Health & Family Welfare (MoHFW)**, Government of India. **Hence statement 1 is correct.**
- One of the **critical components of the Abhiyan is identification and follow up of high risk pregnancies**. A sticker indicating the condition and risk factor of the pregnant women would be added onto MCP card for each visit: Green Sticker- for women with no risk factor detected Red Sticker – for women with high risk pregnancy. **Hence statement 2 is correct.**
- The program aims to provide assured, comprehensive and quality antenatal care, free of cost, universally to all pregnant women on the 9th of every month. It guarantees a minimum package of antenatal care services to women in their 2nd / 3rd trimesters of pregnancy **at designated government health facilities. Hence statement 3 is not correct.**

Source: [CLICK HERE](#)

Q.22) With reference to 'Nirbhaya fund', consider the following statements

1. It is a non-lapsable corpus fund established by Union Home Affairs Ministry for implementation of initiatives aimed at enhancing the safety and security for women
2. Integrated Emergency Response Management System which aims to provide round the clock security to women passengers in all Railway Stations was established under this fund

Select the correct statement(s)

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

Q.22) Solution (b)

Explanation:

- It is a non-lapsable corpus fund established by **Union Finance Ministry** for implementation of initiatives aimed at enhancing the safety and security for women in the country. **Hence statement 1 is not correct.**
- Integrated Emergency Response Management System which **aims to provide round the clock security to women passengers in all Railway Stations** was established under this scheme. Central Victim Compensation Scheme (CVCF), Emergency Response Support

System (ERSS) are some of the other schemes established under Nirbhaya Fund. **Hence statement 2 is correct.**

Source: [CLICK HERE](#)

Q.23) With reference to 'Indian Regional Navigation Satellite System (IRNSS)', consider the following statements

1. The constellation consists of seven satellites located in geostationary orbit (GEO) and provides Standard Positioning Service and a Precision Service
2. Unlike GPS which is dependent only on L-band, NavIC has dual frequencies (S and L bands)

Select the correct statement(s)

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

Q.23) Solution (b)

Explanation:

- The constellation consists of 7 active satellites. Three of the **seven satellites in constellation are located in geostationary orbit (GEO) and four are in inclined geosynchronous orbit (IGSO)**. NavIC signals will consist of a Standard Positioning Service and a Precision Service. Both will be carried on L5 (1176.45 MHz) and S band (2492.028 MHz). **Hence statement 1 is not correct**
- **Unlike GPS, which is dependent only on L-band, NavIC has dual frequencies (S and L bands)**. When a low-frequency signal travels through atmosphere, its velocity changes due to atmospheric disturbances.
- The US banks on an atmospheric model to assess frequency error, and it has to update this model from time to time to assess the exact error. In India's case, the actual delay is assessed by measuring the difference in delay of the two frequencies (S and L bands). **Hence statement 2 is correct**

Source: [CLICK HERE](#)

Q.24) Consider the following statements about Agni-5 Missile

1. It is a nuclear capable missile with two-stage liquid-fuelled engine.
2. Agni-5 can strike targets at ranges of 7,000 to 7,500 km.
3. The missile is operated by the Strategic Forces Command (SFC).

Choose the incorrect statements:

- a) 1, 2 and 3
- b) 1 and 2
- c) 2 only
- d) None

Q.24) Solution (b)

Explanation:

- The nuclear-capable missile, which uses a **three-stage solid fuelled engine**, has been developed by DRDO. **Hence statement 1 is not correct.**
- Medium to Intercontinental versions of Agni missile systems 1 to 5 have varying ranges, starting from 700 km for Agni-1 to 5000 km and above for Agni-5. **Agni-5 can strike targets at ranges of 5,000 to 5,500 km. Hence statement 2 is not correct**
- The missile is **operated by the Strategic Forces Command (SFC)**. **Hence statement 3 is correct.**

Source: [CLICK HERE](#)

Q.25) 'Orans' seen in news recently is a term used to refer to

- a) Transition zones
- b) Sacred spaces
- c) Water conservation system
- d) Summer pastures

Q.25) Solution (b)

Explanation:

- The **orans** are among the last natural habitats of the great Indian bustard. The open stretch of land, which receives long hours of sunlight and brisk winds, has become a hub of green energy with windmills and solar photovoltaic dotting it. They are community-conserved sacred spaces which are currently classified as wastelands.

Source: [CLICK HERE](#)

Q.26) Set P comprises all multiples of 4 less than 500. Set Q comprises all odd multiples of 7 less than 500; Set R comprises all multiples of 6 less than 500. How many elements are present in $P \cup Q \cup R$?

- a) 202
- b) 243
- c) 228
- d) 186

Q.26) Solution (a)

Explanation:

This question involves both Number Systems and Set Theory.

Set P = {4, 8, 12, ..., 496} \mapsto 124 elements {all elements from $1 * 4$ to $124 * 4$ }

Set Q = {7, 21, 35, 49, ..., 497} \mapsto { $7 * 1, 7 * 3, 7 * 5, \dots, 7 * 71$ } \mapsto 36 elements.

Set R = {6, 12, 18, 24, ..., 498} \mapsto { $6 * 1, 6 * 2, 6 * 3, \dots, 6 * 83$ } \mapsto 83 elements.

Sets P and R have only even numbers; set Q has only odd numbers. So,

$P \cap Q = \text{Null set}$

$Q \cap R = \text{Null set}$

$P \cap Q \cap R = \text{Null set}$

So, if we find $P \cap R$, we can plug into the formula and get $P \cup Q \cup R$

$P \cap R = \text{Set of all multiples of 12 less than 500} = \{12, 24, 36, \dots, 492\}$

$= \{12 * 1, 12 * 2, 12 * 3, \dots, 12 * 41\} \mapsto$ This has 41 elements

$$P \cup Q \cup R = P + Q + R - (P \cap Q) - (Q \cap R) - (R \cap P) + (P \cap Q \cap R)$$

$$P \cup Q \cup R = 124 + 36 + 83 - 0 - 0 - 41 + 0 = 202$$

Q.27) Set A comprises all three digit numbers that are multiples of 5, Set B comprises all three-digit even numbers that are multiples of 3 and Set C comprises all three-digit numbers that are multiples of 4. How many elements are present in $A \cup B \cup C$?

- a) 405
- b) 420
- c) 436
- d) 458

Q.27) Solution (b)

Explanation:

Set A = {100, 105, 110.....995} \mapsto {5 * 20, 5 * 21..... 5 * 199} \mapsto 180 elements.

Set B = {102, 108, 114.....996} \mapsto {6 * 17, 6 * 18, 6 * 19..... 6 * 166} \mapsto 150 elements.

Set C = {100, 104, 108.....996} \mapsto {4 * 25, 4 * 26..... 4 * 249} \mapsto 225 elements.

$\rightarrow A \cap B = \{120, 150, 180.....990\} \mapsto$ All 3-digit multiples of 30 \mapsto 30 elements.

$\rightarrow B \cap C = \{108, 120, 132.....996\} \mapsto$ All 3-digit multiples of 12 \mapsto 75 elements.

$\rightarrow C \cap A = \{120, 140, 160.....980\} \mapsto$ All 3-digit multiples of 20 \mapsto 45 elements.

$\rightarrow A \cap B \cap C = \{120, 180.....960\} \mapsto$ All 3-digit multiples of 60 \mapsto 15 elements.

$$A \cup B \cup C = A + B + C - A \cap B - B \cap C - C \cap A + A \cap B \cap C$$

$$= 180 + 150 + 225 - 30 - 75 - 45 + 15 = 420$$

Q.28) In a 729 litres mixture of milk and water, the ratio of milk to water is 7:2 to get a new mixture containing milk and water in the ratio 7:3, the amount of water to be added is:

- a) 81 litres
- b) 71 litres
- c) 56 litres
- d) 50 litres

Q.28) Solution (a)

Explanation:

Quantity of milk in 729 litre of mixture

$$= 7 * (729/9)$$

$$= 567 \text{ litre}$$

Quantity of water

$$= 729 - 567$$

$$= 162 \text{ litres}$$

Let x litre of water be added to become ratio 7 : 3

$$\frac{567}{729 + X} = \frac{162 + X}{729 + X}$$

$$\frac{567}{162 + X} = \frac{729 + X}{729 + X}$$

$$\frac{567}{162 + X} = \frac{7}{3}$$

$$\text{Or, } 7/3 = 567/162+x$$

$$\text{Or, } 162 \times 7 + 7x = 567 \times 3$$

$$\text{Or, } 7x = 1701 - 1134 = 567$$

$$\text{Or, } x = 567/7$$

= 81 litres water is to be added.

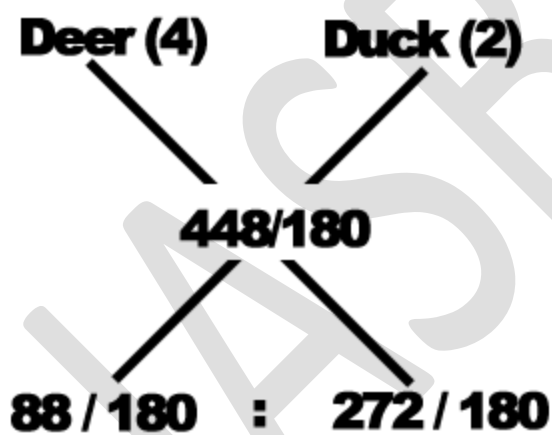
Q.29) In a zoo, there are deer and ducks. If the heads are counted, there are 180, while the legs are 448. What will be the number of deer in the zoo?

- a) 136
- b) 68
- c) 44
- d) 22

Q.29) Solution (c)

Explanation:

Average legs per head = $448/180$



Deers : Ducks = 88 : 272

Hence, the number of Deers = $(180 \times 88) / 360 = 44$

Read the following passage and answer the item that follow. Your answer to these items should be based on the passages only

Passage 1

There are good reasons why the 'Heart of Asia' conference, part of a 14-nation process begun in 2011 to facilitate the development and security of Afghanistan, is so named. The obvious one is geographical, as Afghanistan lies at the junction of Central, South and East Asia, and also of the ancient trading routes from China and India to Europe. Today it is also a focal point for the region's biggest challenge of terrorism; some of the far-reaching battles against al-Qaeda, Islamic State, etc. will be decided on the battlegrounds of Afghanistan. For India, putting terror centre stage at the Heart of Asia declaration in Amritsar was thus timely and necessary. In tandem, Afghan President Ashraf Ghani and Prime Minister Narendra Modi focussed their concerns on cross-border terrorism emanating from Pakistan, something even Pakistan's traditional allies at the conference, including China, Saudi Arabia, the UAE and Turkey, found difficult to counter. The case Mr. Ghani made was clear: progress and development in Afghanistan are meaningless and unsustainable without peace, and peace is contingent on Pakistan ending support to terror groups such the Haqqani network and Lashkar-e-Taiba. He dared Pakistan to use its proposed development grant to Afghanistan to fight terror on its own soil.

Q.30) What according to the author was the initial agenda for the 'Heart of Asia' conference?

- a) To strategically invade the intruders of peace and to wage war against terrorism
- b) To make Afghanistan from the Asian 'Hub' to the trading central between East Asia and Europe
- c) To bring out Afghanistan's potential as Asian 'Hub' and to facilitate development and security in Afghanistan.
- d) To plan the strategy of utilizing its potential as the focal point of terrorism and attack Pakistan

Q.30) Solution (c)

Explanation:

Refer to, "There are good reasons why the 'Heart of Asia' conference, part of a 14-nation process begun in 2011 to facilitate the development and security of Afghanistan, is so named. The Heart of Asia process thus remains critical to forging cooperation to realise Afghanistan's potential to be a vibrant Asian "hub".

Hence, option c is correct.