SFG – FRC for CSE 2024 | Geography #4 – Solutions | ForumIAS

Q.1)
Ans) b
Exp) Option (b) is the correct answer.
Statement 1 is incorrect. Antarctic Circle will witness sunlight for the whole day on the 22nd of Dec due to the axial tilt of Earth.
Statement 2 is correct. Arctic Circle will witness complete daylight on 22nd of June. Region north of circle, number of days with complete sunlight increases until poles where there will be six months of complete daylight.

Q.2)
Ans) a
Exp) Option (a) is the correct answer.
Statement 1 is incorrect. 'Equinox' is time of the year when the sun is directly overhead the equator. We witness two equinox- Spring equinox (21st march) and Autumn equinox (23rd September).
Statement 2 is correct.Tropic refers to line above which the sun is never overhead. Summer solstice (21st June) is when the Sun is overhead Tropic of Cancer, while winter solstice (22nd December) is when the sun overhead Tropic of Capricorn.

Q.3)
Ans) c
Exp) Option (c) is the correct answer.
Statement 1 is correct. Longitude is the angular distance, measured in degrees along east or west of the Prime Meridian.
Statement 2 and 3 are correct. Parallels of latitude become shorter poleward to finally converge at the poles. Hence distance between two longitudes is maximum at the equator and zero at the poles. This is why longitudes are not used for calculating distances.

Q.4)
Ans) c
Exp) Option (c) is the correct answer.
Statement 1 is correct. The atmosphere is made up of gases and vapors. It receives incoming solar radiation from the sun. This gives rise to Climate. Climate varies from place to place depending upon its composition and the amount of sunlight it receives.
Statement 2 is correct. The atmosphere also has an unpredictable proportion of water, existing in all three states of matter. It is because of this variable content of water in the atmosphere that we have great contrasts in weather and climate over different regions of the world.

Q.5)
Ans) c
Exp) Option (c) is the correct answer.
Temperature inversion occurs in hilly areas. It occurs when a hot day is followed by a cloudless, windless night. The air during this phenomenon cools rapidly over the higher ground. It causes the cold air to sink and get trapped in the valley below.
As the cold air is trapped below the warm air in the valley it cannot rise and escape. It leads to a considerable lowering of valley temperature than the temperature of the slopes above.
Temperature inversion is when the lapse rate has reversed. It is when the higher altitude has a higher temperature than lower altitude.

Q.6)

Ans) c

Exp) Option (c) is the correct answer.

Statement 1 is correct. The difference between maximum and minimum temperatures of a day gives the diurnal range of temperature. The difference between the hottest and coldest month of the year gives the annual range of temperature.

Statement 2 is correct. The amount of water vapor present in the air, measured in grams per meter cube is humidity. The ratio between the actual amount of water vapor in the air and the total amount that the air can hold at a given temperature is relative humidity.

Q.7)

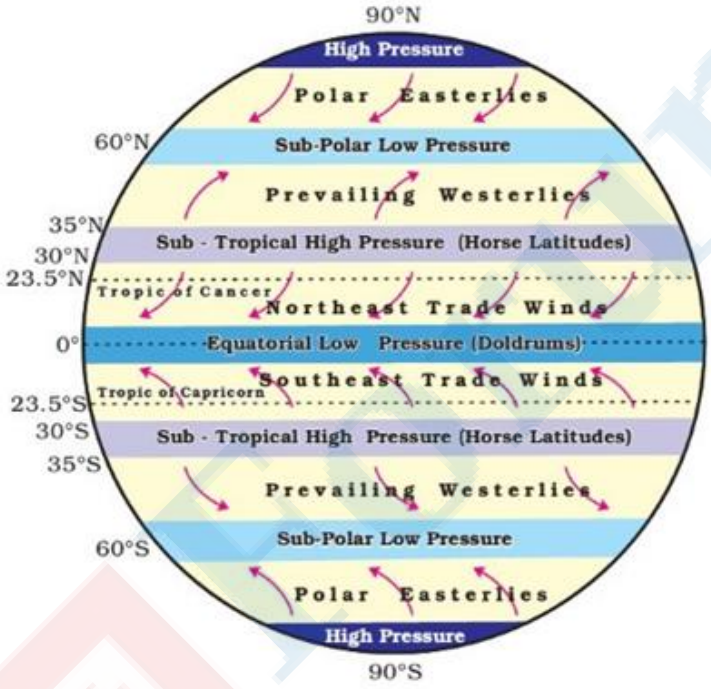
Ans) c

Exp) Option (c) is the correct answer.

Statement 1 is incorrect. The planetary winds blow from high pressure to low pressure.

Statement 2 is incorrect. However, they do not blow directly from one pressure belt to another. Instead they tend to deflect towards the left in the southern hemisphere, and towards the right in the northern hemisphere. This deflection is the result of Coriolis force. It follows Ferrel's law of deflection.

The Coriolis force is zero at the equator and increases progressively towards the poles.



Major Pressure Belts and Wind System

Planetary Winds: The winds blowing throughout the year from high pressure belts to low pressure belts in the same direction are called "planetary or prevailing winds". Due to the effect of the rotation of the earth, the direction of the winds tends to deflect, instead of blowing directly from one pressure belt to another. These winds blow throughout the year and are controlled by the latitudinal pressure belts. They blow over vast areas of continents and oceans.

The main planetary winds are:

1. Trade winds
2. Westerlies
3. Polar Easterlies

Q.8)

Ans) d

Exp) Option (d) is the correct answer.

Statement 1 is incorrect. The rate of heating differs between land and water surfaces.

Land heats up more quickly than water and it's made up of many different materials which absorb the Sun's rays differently. The opaque nature of land allows greater absorption. Texture also matters. Rougher and dryer materials absorb more radiation than smoother and wetter materials. All the absorbed heat is concentrated on the surface so the temperature rises faster.

Statement 2 is incorrect. A reason for this is that water is transparent and absorbs heat slower. It is also in constant motion and the heat absorbed by it is distributed over a greater depth and area. Any appreciable rise in water temperature requires time.

Another reason is of land heating up faster than water is the heat capacity. Heat capacity is a measure of the amount of heat necessary to raise the temperature of one mole of a pure substance by one degree Kelvin, but intuitively it means how much heat energy you have to "pay up" in order to increase the temperature (or hotness) of a particular substance.

Water is great at "storing heat", because it takes a lot of heat energy to actually heat it as compared to say metal and sand.

Q.9)

Ans) d

Exp) Option (d) is the correct answer.

Lapse rate is the rate of change in temperature observed while moving upward through the Earth's atmosphere. The lapse rate is considered positive when the temperature decreases with elevation, zero when the temperature is constant with elevation, and negative when the temperature increases with elevation (temperature inversion). The lapse rate of non-rising air—commonly referred to as the normal, or environmental, lapse rate—is highly variable, being affected by radiation, convection, and condensation; it averages about 6.5 °C per kilometre (18.8 °F per mile) in the lower atmosphere (troposphere).

Statement 1 is incorrect. The rate of decrease of temperature with altitude is not constant. It varies from place to place and from season to season. For practical purposes it might be taken to be 0.6 °C per 100 meters.

Statement 2 is incorrect. This rate of variation, known as Lapse Rate, is more in summer than in winter. It is due to the greater solar insolation on the surface of the earth.

KB) There are three types of lapse rates that are used to express the rate of temperature change with a change in altitude, namely the dry adiabatic lapse rate, the wet adiabatic lapse rate and the environmental lapse rate.

Q.10)

Ans) c

Exp) Option (c) is the correct answer.

Statement 1 is correct. As the earth axis makes an angle of 66 1/2 degrees with the plane of elliptic, during the month of June when it is summer over the northern hemisphere, the sun rays directly fall on the tropic of cancer. So, this leads to longer days and shorter nights in the northern hemisphere area leading to increase in the daylight as well. In fact, at the poles the daylight persists for almost 6 months without any sunset till the onset of winter.

Length of day and night does vary according to the season and latitudinal position. At the equator the day and night are mostly of equal length all-round the year. As we go poll wards either one of them becomes longer. Example during the summer season in the northern hemisphere, the length of daytime increases

as we go towards poles, and at same time as we move southwards towards Antarctic, the length of night time increases and at the south pole it would be completely dark for 6 months without daylight.
Statement 2 is correct. The brief period between sunrise and full daylight is called dawn and that between sunset and complete darkness is called twilight. During this time the sun is below the horizon and the Earth is receiving refracted light from the sun. At the equator the sun rises and sets in a vertical path thus dawn and twilight are of shorter duration. But in temperate latitudes, the sun rises and sets in an oblique path and the period of refracted light is longer. It is much longer at the poles so much that the winter darkness there is really only twilight most of the time.

Q.11)
Ans) a
Exp) Option (a) is the correct answer.
Statement 1 is correct. The atmosphere is stratified with multiple layers and compositions. The lowermost layer, troposphere, closest to the earth's surface has all the climatic elements confined to it – temperature, precipitation, clouds, pressure and humidity.
Statement 2 is incorrect. Stratosphere lies above the troposphere. It is cold, cloudless, and has very thin air. There are seasonal variations in temperature of this layer..
Statement 3 is correct. The ionosphere is the layer that conducts electrical signals. It makes transmission of short-wave radio transmissions possible over long distances.

Q.12)
Ans) a
Exp) Option (a) is the correct answer.
The Thar Desert covers some 77,000 square miles (200,000 square km) of territory. It is bordered by the irrigated Indus River plain to the west, the Punjab Plain to the north and northeast, the Aravalli Range to the southeast, and the Rann of Kachchh to the south.
Statement 1 is correct. The subtropical desert climate there results from persistent high pressure and subsidence at that latitude.
Statement 2 is incorrect. The prevailing southwest monsoon winds that bring rain to much of the subcontinent in summer tend to bypass the Thar to the east. This is because the Aravallis are situated parallel to the Arabian Sea branch of the Southwest monsoon winds, this does not cause orographic rainfall and thus creates dry conditions.

Q.13)
Ans) b
Exp) Option b is correct.
Statement 1 is Incorrect. During 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.

Q.14)
Ans) b
Exp) Option b is correct

Statement 1 is *Incorrect* - Earth's rotational axis makes an angle of **23.5° with the normal**, i.e. it makes an angle of **66.5° with the orbital plane of the earth (ecliptic plane)**. The plane in which Earth revolves around the sun is called as orbital plane.

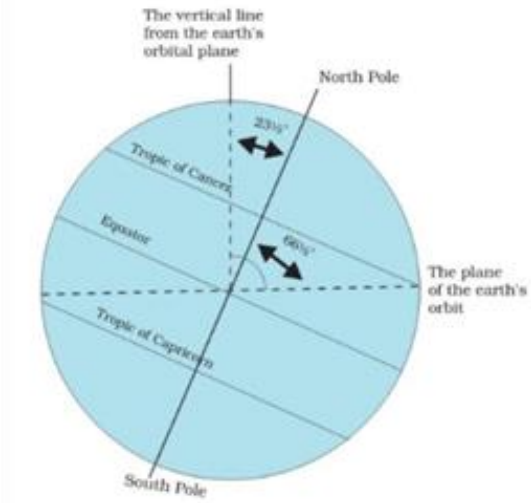


Figure: Inclination of Earth's Axis

Statement 2 is correct – Due to Earth's axial tilt (or obliquity), day and night are not evenly divided. Hemisphere that is tilted towards the Sun is warmer because sunlight travels moredirectly to the Earth's surface so less gets scattered in the atmosphere. That means that when itis summer in the Northern Hemisphere, it is winter in the Southern Hemisphere. The hemispheretilted towards the Sun has longer days and shorter nights. That's why days are longer during thesummer than during the winter. If the Earth's axis were perpendicular to its orbital plane aroundthe Sun, all places on Earth would experience equal amounts of day and night (i.e. 12 hours ofday and night, respectively) every day during the year and there would be no seasonal variability.So the primary cause of changing of length of day and night is the inclination of Earth's Axis.

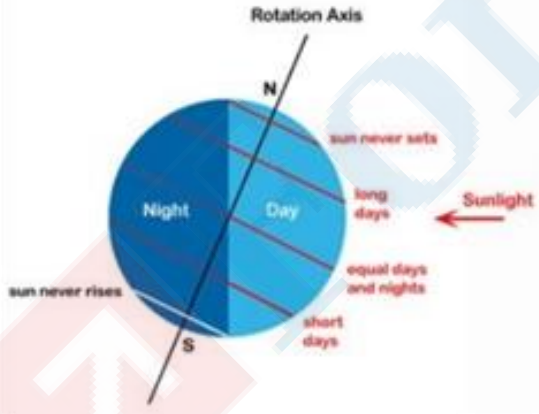


Figure: Length of day and night at different places

Statement 3 is *Incorrect* – Throughout its revolution around the sun, Earth's axis maintains the same alignment relative to the plane of the elliptic and to Polaris. In each position earth is revolving with the axis oriented parallel to itself. This condition is known as axial parallelism. This **parallelism of axis of the Earth is the responsible for apparent movement of the sun over the tropics**.

Perihelion and Aphelion positions occurs because Earth is revolving around the sun in an elliptical orbit with sun at one of its focus. At Perihelion position, sun is nearer to the earth, this occurs is month of January. At Aphelion position, sun is farthest from the Earth, this occurs in the month of July.

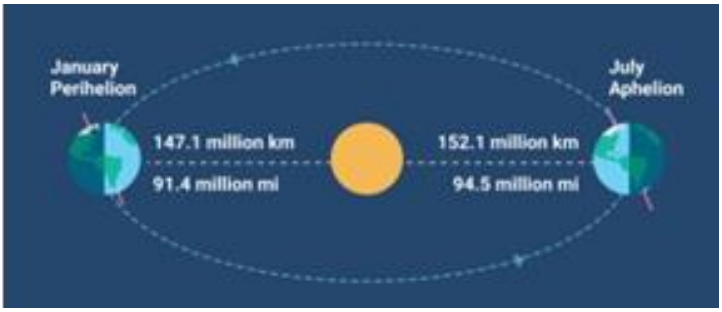


Figure: Perihelion and Aphelion position

Q.15)

Ans) d

Exp) Option d is correct

Iran is a Western Asian country with latitude 32.4279° N, and therefore, it is located above the equator in the northern hemisphere. With a longitudinal coordinate of 53.6880° E, Iran is positioned in the eastern hemisphere as well. The sun shines vertically overhead at the:

1. Equator on 21st March and 23rd September
2. Tropic of Cancer on 21st June
3. Tropic of Capricorn on 22nd December

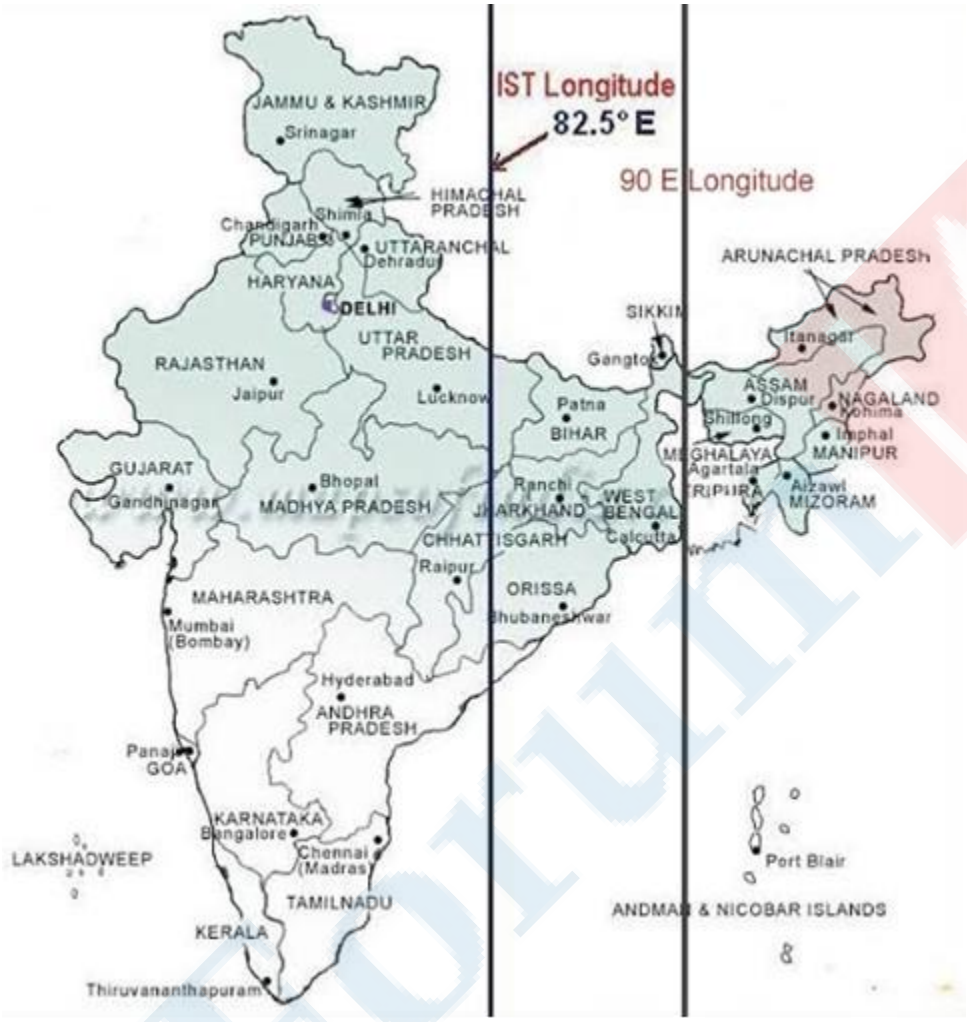
Between the two tropics zones, which includes the equator, the Sun is directly overhead twice per year. Outside the tropic zones, whether to the south or north, the Sun is never directly overhead. Therefore, the tropics marks the limit of the overhead sun, for beyond these, the sun is never overhead anytime of the year. Thus, the sun will not be vertically overhead for one day in a year over Iran as it is outside the tropics.

Q.16)

Ans) d

Exp) Option (d) is the correct answer.

One has to pass through 5 states - Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Odisha and Andhra Pradesh.



Q.17)

Ans) c

Exp) Option c is correct.

Option a is Incorrect. Earth do not receive even radiation across its surface during any given day of a year. There are variations in the amount of radiation received at the earth's surface. Some part of the earth has surplus radiation balance while the other part has deficit.

Between 40 degrees north and south and the regions near the poles have a deficit. The There is a surplus of net radiation balance surplus heat energy from the tropics is redistributed pole wards and as a result the tropics do not get progressively heated up due to the accumulation of excess heat or the high latitudes get permanently frozen due to excess deficit.

Option b is Incorrect. About half of the total insolation received by earth is absorbed by its surface. If insolation received at the top of the atmosphere is 100 units, then 47 unit is absorbed by earth's surface.

Option c is correct. The earth as a whole does not accumulate or loose heat. It maintains its temperature. This happen because the amount of heat received in the form of insolation equals the amount lost by the earth through terrestrial radiation.
Option d is Incorrect. Only about one-third of the total insolation is reflected back to space even before reaching the earth's surface.Out of 100 units of total insolation received by earth, 35 units are reflected back to space even before reaching the earth's surface. Of these, 27 units are reflected back from the top of the clouds and 2 units from the snow and ice-covered areas of the earth. The reflected amount of radiation is called the albedo of the earth.

Q.18)
Ans) a
Exp) Option (a) is the correct answer.
Earth does not have a featureless surface. The topographical variations are the major factors modifying the distribution of insolation. Variability in elevation, surface orientation (slope and aspect), and obstruction by surrounding topographic features creates strong local gradients of insolation.
Statement 1 is correct. With regards to factors affecting temperature in mountain ranges, the steep slope experiences a much more rapid change in temperature than a gentle slope.
Statement 2 is incorrect. Those mountain ranges which have an east-west alignment show higher temperatures on the south facing slope, the sunny slope. The sheltered north-facing slope has lower temperature. The greater insolation of the south facing slope is better suited for wine cultivation and has a more flourishing vegetative cover.
KB) The angle of inclination of the sun's rays – Since the earth is round, the sun's rays strike the surface at different angles at different places. The angle formed by the sun's rays with the tangent of the earth's circle at a point is called angle of incidence. It influences the insolation in two ways as follows:
When the sun is almost overhead, the rays of the sun are vertical. The angle of incidence is large. Hence, they are concentrated in a smaller area, giving more amount of insolation at that place. If the sun's rays are oblique, angle of incidence is small and the sun's rays have to heat up a greater area, resulting in less amount of insolation received there.
The sun's rays with small angle traverse more of the atmosphere than rays striking at a large angle. Longer the path of the sun's rays, greater is the amount of reflection and absorption of heat by the atmosphere. As a result, the intensity of insolation at a place is less. Angle of inclination of solar radiation depends on the latitude of a place. The higher the latitude the less is the angle they make with the surface of the earth resulting in slant sun rays.

Q.19)
Ans) a
Exp) Option a is correct.
Pair 1 is *Incorrectly* matched. The transfer of heat through horizontal movement of air is called advection. Horizontal movement of the air is relatively more importantthan the vertical movement. In middle latitudes, most of diurnal (day and night) variation in daily weather are caused by advection alone. In tropical regions particularly in northern India during summer season local winds called 'loo' is the outcome of advection process.
Pair 2 is correctly matched. The air in contact with the land gets heated slowly and the upper layers in contact with the lower layers also get heated. This process is called conduction. Conduction takes place when two bodies of unequal temperature are in contact with one another, there is a flow of energy from the warmer to cooler body. The transfer of heat continues until both the bodies attain the same temperature or the contact is broken. Conduction is important in heating the lower layers of the atmosphere.

Pair 3 is *Incorrectly* matched. The air in contact with the earth rises vertically on heating in the form of currents and further transmits the heat of the atmosphere. This process of vertical heating of the atmosphere is known as convection. The convective transfer of energy is confined only to the troposphere.

Q.20)
Ans) b
Exp) Option b is correct.
Statement 1 is incorrect. The rotation of the earth about its axis affects the direction of the wind. This force is called the Coriolis force after the French physicist who described it in 1844.
Statement 2 is correct. The Coriolis force is directly proportional to the angle of latitude. It is maximum at the poles and is absent at the equator.
Statement 3 is correct. Coriolis Force deflects wind to the right direction in the northern hemisphere andto the left in the southern hemisphere. The deflection is more when the wind velocity is high.

Q.21)
Ans) d
Exp) Option d is correct.
Atmosphere is **the thin layer of air that surrounds the earth**. It is made up of various gases such as oxygen, nitrogen, carbon dioxides, dust particles and water vapour. The gravitational force of the earth holds the atmosphere around it. It protects us from harmful rays and scorching heat of the sun.
What Would Happen if the atmosphere of the earth suddenly disappears completely?
Statement 1 is correct: It would be **silent**. Sound requires a medium to transmit waves. One could feel vibrations from the ground, but One **wouldn't hear anything.**
Statement 2 is correct: Birds and planes would fall from the sky. Although we can't see air (except clouds), it has mass that supports flying objects.
Statement 3 is correct: Even if one is handed **an oxygen mask, one wouldn't be able to breathe.** This is because our **diaphragm uses the pressure difference between the air inside our lungs and outside our body** to inhale.
Statement 4 is correct: The rivers, lakes, and oceans would boil. Boiling occurs whenever vapor pressure of a liquid exceeds external pressure. In a vacuum, water readily boils, even if the temperature is warm.
Although water would boil, the water vapor would not fully replenish the atmospheric pressure. An equilibrium point would be reached where there would be enough water vapor to prevent the oceans from boiling off. The remaining water would freeze.
Knowledge Base: Eventually (long after surface life had died), solar radiation would break atmospheric water into oxygen, which would react with carbon on the Earth to form carbon dioxide. The air would still be too thin to breathe.
The lack of atmosphere would chill the Earth's surface. We're not talking absolute zero cold, but the temperature would drop below freezing. Water vapor from the oceans would act as a greenhouse gas, raising the temperature. Unfortunately, the increased temperature would allow more water to transition from the sea into the air, likely leading to a runaway greenhouse effect and making the planet more like Venus than Mars.
Organisms that need air to breathe would die. Plants and land animals would die. Fish would die. Most aquatic organisms would die. However, some bacteria could survive, so losing the atmosphere wouldn't kill all life on Earth. Chemosynthetic bacteria wouldn't even notice the loss of atmosphere.
Volcanoes and geothermal vents would continue to pump out carbon dioxide and other gases to add to the water. The most significant difference between the original and new atmosphere would be the much

lower abundance of nitrogen. Earth could replenish some nitrogen from meteor strikes, but most of it would be lost forever.

Q.22)
Ans) b
Exp) Option (b) is the correct answer.
The stratosphere is a layer of Earth's atmosphere. It is the second layer of the atmosphere as you go upward. The troposphere, the lowest layer, is right below the stratosphere. The next higher layer above the stratosphere is the mesosphere.
Statement 1 is incorrect. The stratosphere is very dry; air there contains little water vapor. Because of this, few clouds are found in this layer; almost all clouds occur in the lower, more humid troposphere. Polar stratospheric clouds (PSCs) are the exception. PSCs appear in the lower stratosphere near the poles in winter. They are found at altitudes of 15 to 25 km (9.3 to 15.5 miles) and form only when temperatures at those heights dip below -78° C. They appear to help cause the formation of the infamous holes in the ozone layer by "encouraging" certain chemical reactions that destroy ozone. PSCs are also called nacreous clouds.
Statement 2 is correct. There is a vertical stratification in the Stratosphere, with warmer layers above and cooler layers below, which makes the stratosphere dynamically stable: there is no regular convection and associated turbulence in this part of the atmosphere. Due to the lack of vertical convection in the stratosphere, materials that get into the stratosphere can stay there for a long time. Such is the case for the ozone-destroying chemicals called CFCs (chlorofluorocarbons).
Large volcanic eruptions and major meteorite impacts can fling aerosol particles up into the stratosphere where they may linger for months or years, sometimes altering Earth's global climate. Rocket launches inject exhaust gases into the stratosphere, producing uncertain consequences.
KB) Jet liners, however, face another menace in the stratosphere, namely jet streams. Jet streams are high velocity horizontal air currents. The main jet streams are located near the tropopause, the transition between the troposphere (where temperature decreases with altitude) and the stratosphere (where temperature increases with altitude). The location of the jet stream is extremely important for aviation. Jet streams are NOT always harmful for aviation. They are beneficial and used commercially as it reduced the trip time and fuel consumption.
The bottom of the stratosphere is around 10 km (6.2 miles or about 33,000 feet) above the ground at middle latitudes. The top of the stratosphere occurs at an altitude of 50 km (31 miles). The height of the bottom of the stratosphere varies with latitude and with the seasons. The lower boundary of the stratosphere can be as high as 20 km (12 miles or 65,000 feet) near the equator and as low as 7 km (4 miles or 23,000 feet) at the poles in winter. The lower boundary of the stratosphere is called the tropopause; the upper boundary is called the stratopause.

Q.23)
Ans) b
Exp) Option b is correct.
The equator does not experience the highest temperatures on Earth. Here, rising air generates daily thunderstorms that consume considerable amounts of heat energy, suppressing the air temperature by several degrees Celsius. The greater cloud cover also helps to reduce the amount of sunlight.
Statement b is correct. Rising air currents generated at the equator helps in the formation of clouds over equatorial regions, which then cause rains and thunderstorms. This phenomenon helps in lowering the temperature at equator. On the other hand at tropics, during its descent the dry air becomes even hotter. Thus, as the dry air descends from high altitudes, its compression leads to an increase in its temperature.

The dry air becomes even hotter during its descent into the tropical regions. This is because as the dry air descends from high altitudes, its compression leads to an increase in its temperature. Typically, when moist air descends through 1 kilometer, it becomes hotter by 6 degrees Celsius, but it increases by 10 degrees Celsius when the air is dry.
So, if air temperature at the equator is 30 degrees Celsius, by the time it rises 10 kilometers in the sky, travels poleward and eventually descends into the tropics, it's temperature would be raised by around 12 degrees. Therefore, air temperature in the tropics (42 degrees Celsius) is greater than that of the Equator (30 degrees Celsius). This is why tropical regions are hotter than the Equator.

Q.24)
Ans) c
Exp) Option c is correct.
Temperature inversion is a reversal of the normal behavior of temperature in the troposphere. Under this meteorological phenomenon a layer of warm air lies over the cold air layer.
Temperature inversions play an important role in determining cloud forms, precipitation, and visibility. An inversion acts as a cap on the upward movement of air from the layers below. As a result, convection produced by the heating of air from below is limited to levels below the inversion. Diffusion of dust, smoke, and other air pollutants is likewise limited.
Statement 1 is incorrect. Formation of convective clouds is retarded during temperature inversion. In regions where a pronounced low-level inversion is present, convective clouds cannot grow high enough to produce showers. Inversion of temperature causes atmospheric stability which stops upward (ascent) and downward (descent) movements of air.
Statement 2 is correct. Visibility is greatly reduced below the inversion due to the accumulation of dust and smoke particles. Because air near the base of an inversion tends to be cool, fog is frequently present there.
Statement 3 is correct. Inversions affect diurnal variations in temperature. Diurnal variations tend to be very small. Diurnal temperature variation is the variation between a high air temperature and a low temperature that occurs during the same day.
Statement 4 is correct. Temperature inversion is economically unfavourable weather for crops. Inversion of temperature causes frost when the condensation of warm air due to its cooling by cold air below occurs at temperature below freezing point. Frost is definitely economically unfavourable weather phenomenon mainly for crops because fruit orchards and several agricultural crops such as potatoes, tomatoes, peas etc. are totally damaged overnight.

Q.25)
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.

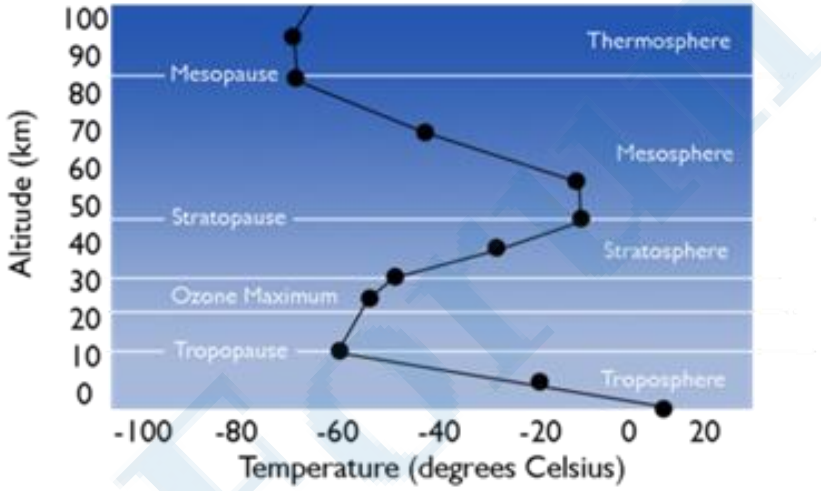
Q.26)
Ans) c
Exp) Option c is correct.
Statement 1 is correct. Temperature is uniform throughout the year with the mean monthly temperatures always around 27° C with very little variation in Equatorial regions. There is no winter and regular land and sea breezes assist in maintaining a truly equable climate. The diurnal range of temperature is small, and so is the annual range. The diurnal range of temperature is the difference between the maximum and the minimum temperatures of the day.
Statement 2 is correct. Precipitation is heavy and well distributed throughout the year with annual average always above 150 cm. In some regions the annual average may be as high as 250 – 300 cm. There is no month without rain and distinct dry season is absent. There is much evaporation and convectional air currents are set up, followed by heavy thunderstorms in the afternoons.
Statement 3 is correct. High temperature and abundant rainfall support a luxuriant tropical rain forest. In the Amazon lowlands, the forest is so dense that it is called 'Selvas'. Selvas are a dense tropical rainforest usually having a cloud cover (dense canopy). The growing season here is all the year round-seeding, flowering, fruiting and decaying do not take place in a seasonal pattern. The equatorial vegetation comprises a multitude of evergreen trees that yield tropical hardwood, e.g., mahogany, ebony, dyewoods etc.
Statement 4 is incorrect. It is not easy to revive forests in equatorial regions. The fertility of top soil in rainforest regions is very poor. Torrential downpours wash out most of the top soil nutrients and the soil deteriorates rapidly with subsequent soil erosion and soil impoverishment. It takes decades to replenish the soil of lost nutrients. So, a seed doesn't usually germinate and even if it does, its development is hindered due to little availability of sunlight. Indonesian island of Java is an exception because of its rich volcanic ashes.

Q.27)
Ans) c
Exp) Option c) is correct.
Statement 1 is Incorrect: When earth orbits the sun, it moves between the sun and the moon. If this happens, earth blocks the sunlight that normally is reflected by the moon and Earth's shadow falls on it.
When the moon orbits Earth, it moves between the sun and Earth. When this happens, the moon blocks the light of the sun from reaching Earth. This causes an eclipse of the sun.
Statement 2 is Incorrect: A Lunar eclipse can occur only when the moon is full, while a solar eclipse can only happen at a new moon
Knowledge Base: A lunar eclipse usually lasts for a few hours, while solar eclipses only last for a few minutes.

Q.28)
Ans) b
Exp) Option (b) is the correct answer.

Statement 1 is correct and 2 is incorrect. In contrast to the windward side of a mountain which is moist, the leeward side typically has a dry, warm climate. This is because by the time air rises up the windward side and reaches the summit, it has already stripped of the majority of its moisture. As this already dry air descends down the lee, it warms and expands (a process known as adiabatic warming), which causes clouds to dissipate and further reduces the possibility of precipitation. This occurrence is known as the rain shadow effect. It is the reason why locations at the base of a mountain lee tend to be some of the driest places on Earth.
Statement 3 is incorrect. The Mojave Desert is an arid rain-shadow desert and the driest desert in North America. It is present on the leeward side of the Rocky mountain.

Q.29)
Ans) d
Exp) Option d is correct.
Statement 1 is correct. The atmosphere is indirectly heated by terrestrial radiation from below. Therefore, the temperature generally decreases with increasing height.
Statement 2 is correct. As height increases, the air goes through the process of expansion. The volume increase that leads to decrease in heat content of the air system.
Statement 3 is correct. The density of air starts to decline with height. The air becomes less dense than air nearer to the sea level. The air at higher altitude exerts less pressure than air at lower altitude. As the pressure decreases, air molecule spreads further and the temperature decreases.



Statement 4 is correct. In the earth's atmosphere, pressure, which is related to the number of molecules per unit volume, decreases exponentially with altitude. Thus, if a parcel of air from the surface rises, it undergoes an expansion, from higher to lower pressure. When you allow air to expand, it cools.
Knowledge Base: The rate of decrease of temperature with height is termed as the normal lapse rate. It is 6.5°C per 1,000 m.

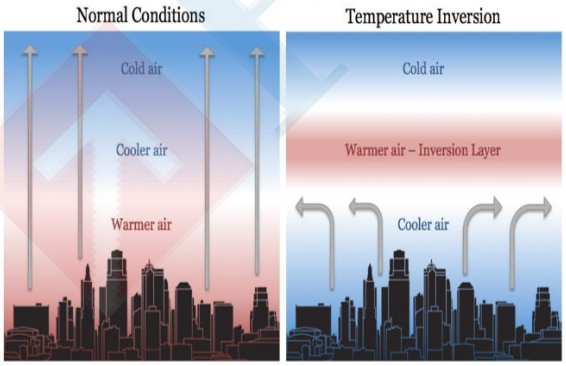
Q.30)
Ans) b
Exp) Option b is correct.
Statement 1 is correct. Albedo is the portion of solar energy reflected from the surface of the Earth back into space. It is a reflection coefficient and has a value of less than one. When the solar radiation passes through the atmosphere, a certain amount of it is scattered, reflected and absorbed. The reflected sum of radiation is called the albedo of the earth. Albedo is an important concept in climatology, astronomy, and

environmental management. It plays a major role in the energy balance of the earth's surface, as it defines the rate of the absorbed portion of the incident solar radiation.
Statement 2 is incorrect. The difference in the average albedo of Earth has an important influence on the temperature of the Earth. If the average albedo is lower than the previous year's albedo, it specifies that the amount of radiation absorbed is higher. This results in the rise in the temperature of the Earth. Earth's albedo is constantly measured using satellites to monitor global warming.
Statement 3 is correct. An increase in global temperature causes snow and ice to melt, which decreases the extent to which they cover the surface, which then decreases Earth's albedo. This decrease in albedo means more energy is absorbed, which causes further warming and in turn causes more melting.

Q.31)
Ans) d
Exp) Option d is correct.
Normally, temperature decreases with an increase in elevation. It is called normal lapse rate. At times, the situation is reversed and the normal lapse rate is inverted. It is called Inversion of temperature. Inversion is usually of short duration but quite common nonetheless.
Following Conditions are favourable for Temperature Inversion:

- Long winter nights: Loss of heat by terrestrial radiation from the ground surface during night may exceed the amount of incoming solar radiation.
- Cloudless and clear sky: Loss of heat through terrestrial radiation proceeds more rapidly without any obstruction.
- Dry air near the ground surface: It limits the absorption of the radiated heat from the Earth's surface.
- Slow movement of air: It results in no transfer or mixing of heat in the lower layers of the atmosphere.
- Snow covered ground surface: It results in maximum loss of heat through reflection of incoming solar radiation.

Surface inversion promotes stability in the lower layers of the atmosphere. Smoke and dust particles get collected beneath the inversion layer and spread horizontally to fill the lower strata of the atmosphere. Dense fogs in mornings are common occurrences especially during winter season. This inversion commonly lasts for few hours until the sun comes up and beings to warm the earth. The inversion takes place in hills and mountains due to air drainage. Cold air at the hills and mountains, produced during night, flows under the influence of gravity. Being heavy and dense, the cold air acts almost like water and moves down the slope to pile up deeply in pockets and valley bottoms with warm air above. This is called air drainage. It protects plants from frost damages.



Q.32)
Ans) d
Exp) Option d is correct.

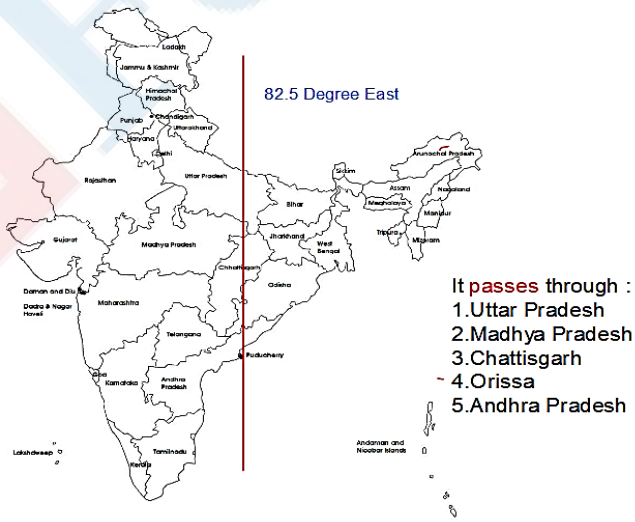
The earth's surface receives most of its energy in short wavelengths. The energy received by the earth is known as incoming solar radiation which in short is termed as insolation.
The amount and the intensity of insolation vary during a day, in a season and in a year. The factors that cause these variations in insolation are:

- The rotation of earth on its axis;
- The length of the day;
- The angle of inclination of the sun's rays;
- The transparency of the atmosphere;
- The configuration of land in terms of its aspect. The last two however, have less influence.

The fact that the earth's axis makes an angle of 66½ with the plane of its orbit round the sun has a greater influence on the amount of insolation received at different latitudes. The second factor that determines the amount of insolation received is the angle of inclination of the rays. This depends on the latitude of a place. The higher the latitude the less is the angle they make with the surface of the earth resulting in slant sun rays. The area covered by vertical rays is always less than the slant rays. If more area is covered, the energy gets distributed and the net energy received per unit area decreases. Moreover, the slant rays are required to pass through greater depth of the atmosphere resulting in more absorption, scattering and diffusion.

Q.33)
Ans) b
Exp) Option b is correct.
Standard time is referred to as the synchronization of clocks within a certain geographical area to a single standard time.
A standard meridian is established in every country so that it is the central longitude of the whole country and at the same time is throughout the country.
The Standard Meridian of India having the longitude 82°30'E, which passes through Mirzapur in Uttar Pradesh is considered as the standard time for the whole country.
The 82½° E (82° 30'E) longitude is the Meridian on which the Indian Standard Time is based, which is 5 hours 30 mins, ahead of Greenwich Mean Time.
Option 1 and 4 are correct. The standard meridian of India passes through the states of Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Orissa and Andhra Pradesh.
Option 2 and 3 are incorrect. It does not pass-through Telangana and Jharkhand.

Standard Meridian of India :



Q.34)

Ans) d

Exp) Option d is correct.

Statement 1 is correct. The most important parameter for Earth-like life is the presence of liquid water, which directly depends on pressure and temperature. Temperature is key both because of its influence on liquid water and because it can be directly estimated from orbital and climate models of exoplanetary systems. We can consider the cold and hot limits.

Statement 2 is correct. An important unique thing about the planet earth is its buffering capacity by virtue of which it maintains a neutral pH (power of hydrogen or potential for hydrogen) in the soil and water bodies. This neutral pH is crucial for the survival and sustenance of all the living creatures.

Statement 3 is correct. On average, Earth's surface temperature is about 57 degrees Fahrenheit; without our atmosphere, it'd be zero degrees. In the last two centuries, humans have added enough greenhouse gases to the atmosphere to raise Earth's average temperature by 1.8 degrees Fahrenheit. Ideal temperature of 17 degrees Celsius.

Statement 4 is correct. The Earth and the Sun are equally important because without the Sun's heat and light, the Earth would be a lifeless ball of ice-coated rocks. It regulates the temperature of water bodies, weather patterns and provides energy to the growth of plants. The distance of the Earth from the Sun makes it a perfect reason for the life because it receives the perfect amount of heat and light to allow life to be created and to support it.

Q.35)

Ans) c

Exp) Option c is correct.

Tides are the periodical rise and fall of the sea level, once or twice a day, caused by combined effect of the gravitational forces exerted by the sun, the moon and rotation or the centrifugal force of Earth. Hence, the correct answer is (c).

Knowledge Base:

- The centrifugal force is the force that acts to counter the balance of gravity. Together, the gravitational pull and the centrifugal force are responsible for creating the two major tidal bulges on the earth. On the side of earth facing the moon, a tidal bulge occurs. While on the opposite side, even though the gravitational attraction of the moon is less as it is farther away, the centrifugal force causes the tidal bulge.
- The 'tide-generating' force is the difference between these two forces; i.e. the gravitational attraction of the moon and the centrifugal force.
- On the surface of earth, nearest to the moon, pull or attractive force of the moon is greater than centrifugal force, 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.

Q.36)

Ans) d

Exp) The factors that influence the temperature of a place are Latitude, Altitude, Continentally, Ocean currents and winds, Slope (shelter and aspect) and Natural vegetation.

Knowledge Base:

Latitude: Due to the earth's inclination, the mid-day Sun is almost over-head within the tropics but the Sun's rays reach the earth at an angle outside the tropics. The temperature thus diminishes from equatorial regions to the poles.
Altitude: The atmosphere is mainly heated by conduction from the earth. Therefore, the places nearer to the earth's surface are warmer than those higher up. Temperature decreases with increasing height above sea level.
Continentality: Land surfaces are heated quickly than water surfaces, because of the higher specific heat of water. Ocean currents and winds: Both ocean currents and winds affect temperature by transporting their heat or coldness into adjacent regions. Cold currents lower the summer temperature. For example, the North Atlantic Drift warm the coastal districts of Western Europe keeping their ports ice-free.
Slope, shelter, and aspect: A steep slope experience a more rapid change in temperature than a gentle one. Mountain ranges that have an east-west alignment like the Alps show a higher temperature on the south-facing sunny slope than the north-facing 'sheltered slope.'
Natural vegetation and soil: Light soils reflect more heat than darker soils which are better absorbers of heat. Dry soils like sands are very sensitive to temperature changes, whereas wet soils, like clay, retain much moisture and warm up or cool down more slowly.
Thick forests cut off much of the incoming insolation and many places the sunlight never reaches the ground.

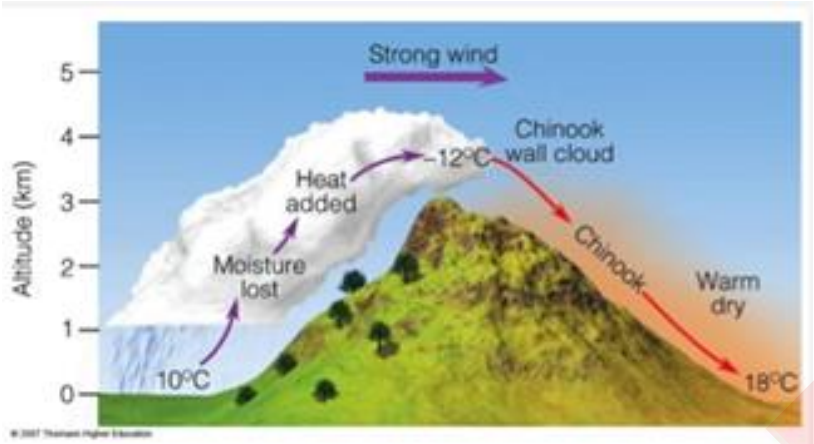
Q.37)
Ans) b
Exp)
1. Mango Shower: Towards the end of summer, there are pre-monsoon showers which are common phenomena in Kerala and coastal areas of Karnataka. Locally, they are known as mango showers since they help in the early ripening of mangoes.
2. Blossom Shower: With this shower, coffee flowers blossom in Kerala and nearby areas.
3. Nor Westers: These are dreaded evening thunderstorms in Bengal and Assam. Their notorious nature can be understood from the local nomenclature of 'Kalbaisakhi', a calamity of the month of Baisakh. These showers are useful for tea, jute and rice cultivation. In Assam, these storms are known as "Bardoli Chheerha".
4. Loo: Hot, dry and oppressing winds blowing in the Northern Plains from Punjab to Bihar with higher intensity between Delhi and Patna.

Q.38)
Ans) a
Exp) Option a is correct
Statement 1 is Incorrect. The thickness of troposphere is greater at the equator as the heated air rises to greater heights.
Statement 2 is correct. Most ozone (about 90%) is found in the stratosphere, which begins about 10–16 kilometers (6–10 miles) above Earth's surface and extends up to about 50 kilometers (31 miles) altitude. The stratospheric region with the highest ozone concentration is commonly known as the "ozone layer". The ozone layer extends over the entire globe with some variation in altitude and thickness.
Statement 3 is Incorrect. In thermosphere temperature increases rapidly with increasing height. Temperature at its upper limit reaches up to 1700-degree C.
Knowledge Base: All the weather phenomena occur in troposphere like cyclones, anticyclones, storms and precipitation.

Q.39)

Ans) b

Exp) Option (b) is the correct answer.



Statement 2 is incorrect. Chinook winds – also known as Foehn winds in other parts of the world – are a type of warm, dry wind that occur on the downward slope of a mountain when warm air has lost its moisture.

Statement 1 and 3 is correct. In Canada, the winds originate from the Pacific Coast. Cool as they blow up the Canadian Rockies, they warm significantly as they drop down the eastern slopes, freeing Calgarians for a few blissful moments from winter's icy grasp. It comes in a south-westerly direction to the prairies and has a considerable effect on the local pastures.

Q.40)

Ans) a

Exp) Option a is the correct answer.

Aphelion is the position of the earth when it is farthest from the sun while perihelion is the position of the earth when it is nearest from the sun.

Statement 1 is correct: Aphelion always happens in early July. About two weeks after the June solstice, Earth is farthest from the Sun. Perihelion always happens in early January. About two weeks after the December Solstice, Earth is closest to the Sun.

Statement 2 is incorrect: Aphelion and Perihelion are not related to Earth's seasons. It's not the distance from the Sun that causes seasons on Earth. Seasons happen because Earth's axis is tilted at an angle. It's because Earth orbits the Sun on a tilt that our planet gets more or less of the Sun's direct rays at different times of the year.

Statement 3 is incorrect: Speed of Earth is fastest at Perihelion and slowest at Aphelion (Kepler's Second Law). Kepler's Second Law says that a line running from the sun to the planet sweeps out equal areas of the ellipse in equal times. This means that the planet speeds up as it approaches the sun and slows down as it departs from it.

Knowledge Base:

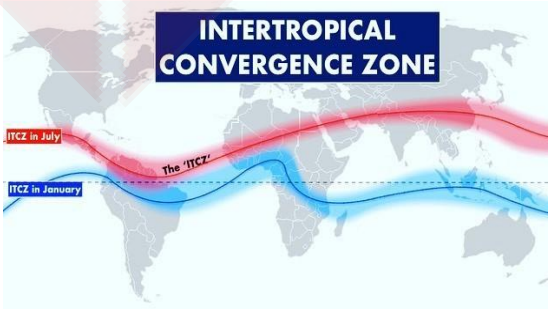
Though aphelion and perihelion are terms mostly used in reference to Earth, they are also relevant to other planets orbiting the Sun. Other planets have points in the orbits when they are farthest or closest away from their star. For example, planet Mars has an even more elliptical orbit than Earth. In comparison, Earth's orbit seems almost circular; this almost-circular orbit is why Earth's climate is relatively stable.

The point in the Moon's orbit that is closest to the Earth is called the "perigee" and the point farthest from the Earth is known as the "apogee."

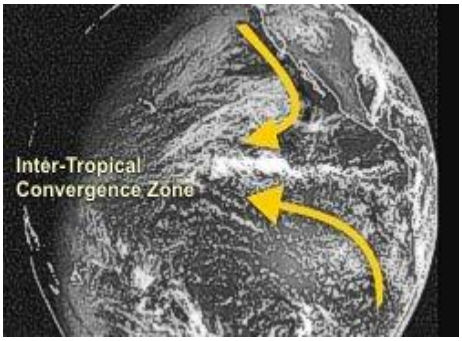
Q.41)
Ans) d
Exp) Option d is the correct answer.
The International Date Line (IDL) is an imaginary line that runs from the North to the South Pole. It roughly follows the 180° line of longitude and passes through the Pacific Ocean. There is a total difference of 24 hours or a whole day between the two sides of the 180° meridian.
Statement 1 is incorrect: While the date line generally runs north to south from pole to pole, it zigzags around political borders such as eastern Russia and Alaska's Aleutian Islands. So, it is not a straight line.
Statement 2 is incorrect: The date changes by exactly one day when International Date Line is crossed. A traveller crossing the date line from east to west loses a day and while crossing the dateline from west to east he/she gains a day.

Q.42)
Ans) b
Exp) Option b is the correct answer
Statement 1 is correct. Polar vortex is described as a whirling cone of low pressure over the poles. It is a large area of low pressure and cold air surrounding both of the Earth's poles.
Statement 2 is incorrect. It may locate near either of a planet's geographical poles. On Earth, the polar vortices are located in the middle and upper troposphere and the stratosphere (not the lower troposphere).
Statement 3 is incorrect. The term vortex refers to counterclockwise (not the clockwise) flow of air that keeps the colder air near the poles.
Statement 4 is correct: A polar vortex strengthens in the winter and weakens in the summer due to the temperature difference between the equator and the poles.

Q.43)
Ans) b
Exp) Option b is the correct answer.
Intertropical Convergence Zone (ITCZ), also called equatorial convergence zone, belt of converging trade winds and rising air that encircles the Earth near the **Equator.**
Statement 1 is correct: The Inter Tropical Convergence Zone (ITCZ) is a low-pressure zone located at the equator where **trade winds converge**, and so, it is a zone where air tends to ascend. In July, the ITCZ is located around 20°N-25°N latitudes (over the Gangetic plain), sometimes called the monsoon trough. This monsoon trough encourages the development of thermal low over north and northwest India.
Statement 2 is incorrect: The ITCZ follows the sun in that the position varies seasonally. **It moves north in the Northern Hemisphere summer and south** in the Northern Hemisphere winter. In July and August, over the Atlantic and Pacific, the ITCZ is **between 5 and 15 degrees north of the Equator**, but further north over the land masses of Africa and Asia. In eastern Asia, the ITCZ may propagate up to 30 degrees north of the Equator.



Statement 3 is correct: The **Inter-Tropical Convergence Zone** (ITCZ) appears as a **band of clouds consisting of showers, with occasional thunderstorms**, that encircles the globe near the equator. The solid band of clouds may extend for many hundreds of miles and is sometimes broken into smaller line segments. It exists because of the convergence of the trade winds.



Band of Clouds over ITCZ

Q.44)

Ans) b

Exp) Option b is correct

Statement 1 is correct – Longitudes are imaginary semi-circles starting from north pole and ending at south pole. All longitudes are equal in length irrespective of their location. Latitudes on the other hand are imaginary parallel lines which make a circle around theEarth. The equator represents the 0oLatitude. All parallel circles from the equator to the poles are called parallels of latitudes. As we move away from the equator, the length of the parallels of latitudes decreases

Statement 2 is Incorrect – The distance between two longitudes is maximum at the equator and decreases steadily pole wards until it becomes zero at the poles, where all meridians meet. Whereas latitudes are equidistant from each other.

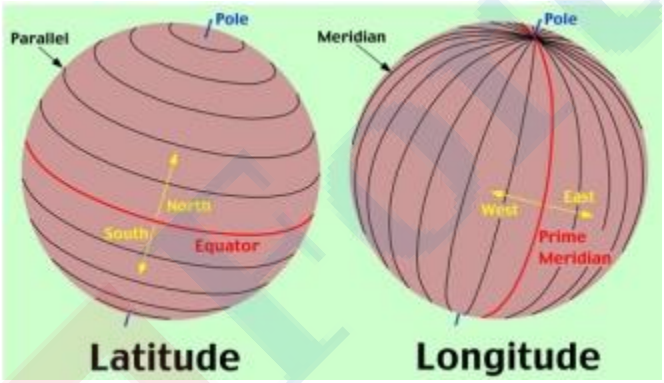


Figure: Latitude and Longitude

Statement 3 is correct –Amount of insolation received at a particular place depends on its latitudinal position. Insolation in the tropics is greater than at the poles. Latitudes are used to classify Earth into various heat zones depending upon the insolation – Torrid zone, Temperate zone and Frigid zone.

Longitudes are used to measure local time of the place. At a particular time, sun is overhead all the places on a longitude. Thus all the places will have same local time. By convention, Greenwich Meridian which is also known as Prime Meridian is taken as reference. All the longitudes towards East of Greenwich is ahead of Greenwich time and those on the west are behind.Knowledge Base: Two latitudes never cross each other whereas all the longitudes meet at the two poles.

Q.45)

Ans) c

Exp) Option (c) is the correct answer.

Blizzard and Buran are a cold, northerly polar winds of Canada and Eurasia respectively, blowing violently at 50 m.p.h or more and at a temperature of 50°F below freezing point. The powdery snow-flakes are blown around in the lower atmosphere and visibility is greatly reduced.

Q.46)

Ans) d

Exp) Option d is the correct answer.

Statements 1, 2, 3 and 4 are correct: The monsoonal climate of India is diverse and different in different parts of the land at different times of the year. The causes of this diversities are:

1. Presence of mountains: The Himalayan mountains in the north play a vital role in influencing the climate of India. During summer, they stop the moist south-west monsoon winds from escaping to Central Asia and cause rainfall in India. During winter, they prevent the chilling polar winds coming from Siberia from entering India, thus keeping the climate of the country comparatively warmer and comfortable.
2. Temporary shift of the pressure belts: The sun's apparent northward and southward movement cause temporary shifting of the pressure belts northwards and southwards by 5°-10°. This leads to temporary changes in the climate conditions including monsoon rainfall.
3. Latitudinal extent: The main landmass of India extends from 8° N in the south to 37° N in the north. Thus, it spreads for about 29° of latitude. The southern part of India experiences hot wet equatorial climate, the central part experiences tropical climate, while the northern part experiences sub-tropical and temperate climate. Southern India experiences intense monsoonal rainfall, while Northern India receives lower average rainfall.
4. Oppositely blowing monsoon winds: India experiences two oppositely blowing monsoon winds in different times of the year. During summer, the monsoon winds blow from the south-west and during winter they reverse their direction and blow from the north-east. This causes formation of seasons.

Q.47)

Ans) d

Exp) Option (d) is the correct answer.

The Ionosphere is the ionized part of Earth's upper atmosphere, from about 60 km (37 mi) to 1,000 km (620 mi) altitude, a region that includes the thermosphere and parts of the mesosphere and the exosphere. The ionosphere is ionized by solar radiation. It plays an important role in atmospheric electricity and forms the inner edge of the magnetosphere. It has practical importance because, among other functions, it influences radio propagation to distant places on the Earth.

Statement 1 is incorrect. Ozone particles and layer is present in the Stratosphere and not in the Ionosphere.

Statement 2 is incorrect. The upper ionosphere is used for radio communication and navigation as it reflects long, medium, as well as short radio waves. Since solar radiation is the main cause of the existence of ionosphere, any variation in the radiation can affect the entire radio communication system. During the first half of the 20th century High frequency (or shortwave) radio waves was widely used for transoceanic telephone and telegraph service, and business and diplomatic communication. Due to its relative unreliability, shortwave radio communication has been mostly abandoned by the telecommunications industry, though it remains important for high-latitude communication where satellite-based radio communication is not possible. Some broadcasting stations and automated services still use shortwave radio frequencies, as do radio amateur hobbyists for private recreational contacts.

Q.48)

Ans) c

Exp) Option c is the correct answer.

During the summer months in India, a sudden contact between dry and moist air masses gives rise to local storms of great intensity. These local storms are associated with violent winds, torrential rains and even hailstorms.

Some Famous Local Storms of Hot Weather Season

(1) Mango Shower: Towards the end of summer, there are pre-monsoon showers which are a common phenomenon in Kerala and coastal areas of Karnataka. Locally, they are known as mango showers since they help in the early ripening of mangoes.

(2) Blossom Shower: With this shower, coffee flowers blossom in Kerala and nearby areas.

(3) Nor Westers: These are dreaded evening thunderstorms in Bengal and Assam. Their notorious nature can be understood from the local nomenclature of 'Kal Baisakhi', a calamity of the month of Baisakh. These showers are useful for tea, jute and rice cultivation. In Assam, these storms are known as "Bardoli Chheerha". (Hence Option c is correct)

(4) Loo: Hot, dry and oppressive winds blowing in the Northern plains from Punjab to Bihar with higher intensity between Delhi and Patna.

Q.49)

Ans) a

Exp) Option (a) is the correct answer.

Radiation from the sun is made of three parts:

(i) Statement 1 is not correct. The visible part of sunlight has the most effect on climate. It is the most intense of all sun radiations.

(ii) Statement 2 is correct. The ultraviolet rays affect our skin, they cause sun burns if the skin is exposed directly for too long.

(iii) Statement 3 is correct. The infra-red radiations can penetrate even dust and fog. They are widely used in photography.

Q.50)

Ans) b

Exp) Option (b) is the correct answer.

The prevailing winds of the Savanna type of climate are the Trade winds, which bring rain to the coastal districts. They are strongest in the summer, but are relatively dry by the time they reach the continental interiors or the western coasts of the continents. In West Africa, the North-East trades blow off-shore from the Sahara Desert and reach the Guinea coast as a dry, dust-laden wind, locally called the 'Harmattan', meaning 'the doctor'.

KB) **Chinook**

These are warm and dry winds blowing on the eastern slopes (leeward side) of the Rocky Mountain. They are the result of adiabatic heating which occurs due to downslope compression on the leeward side, as the mountain barrier creates frictional drag which tends to pull the air from the higher level down on the leeward and air forced down is heated adiabatically and at the same time its relative humidity is also lowered.

The temperature in Chinook is so warm that it can remove the underlying snow cover/ice and sometimes these winds are so dry that in spite of their below freezing temperatures the entire snow cover on the ground disappears, by process of sublimation. Thus, these winds are also known as Chinook, which literally means Snow Eater.

Foehn: Foehn is dry and warm wind resulting due to adiabatic heating on the leeward side of the Mountain range. These winds are more common on the northern side of Alps in Switzerland and with the arrival of these winds, there is a rapid rise in temperature.
Mistral: It is a cold and dry wind which blows in the Spain and France from North-west to South-East direction, mostly occur during winter months.

Q.51)
Ans) d
Exp) Option d is the correct answer.
Option a is incorrect- Circadian Rhythm is the 24 hour natural internal clock of our brain that regulates our alertness and sleepiness by responding to light changes in our environment. The passage indicates that blue light interferes with the Melatonin and indeed affects our circadian rhythm but to assume that if we use blue light filter in smartphone, our circadian rhythm will be proper is not true. Circadian rhythm can depend on other factors as well and not just smartphone.
Option b is incorrect- There is a use of extreme word 'drastically' in the given sentence. The passages says that smartphone can improve productivity only if we use it in moderation. However, the passages does not use the word 'drastically' so this statement is incorrect.
Option c is incorrect- The passage does not talk about the government and its role in the use of smartphone. So this option is also incorrect.
Option d is correct- The passage indicates that smartphones has numerous benefits like staying connected to the loved ones, access information, entertainment on-the-go, and enhance productivity. It can be assumed that staying connected with the loved ones can improve quality of the relationship. Hence, this option is correct.

Q.52)
Ans) c
Exp) Option c is the correct answer.
Option a is incorrect- Option a is incorrect because while it does mention the need for employees to learn new skills and take on new roles and responsibilities, it does not capture the full scope of the passage, which also discusses the impact of technology and globalization on the world of work.
Option b is incorrect- Option b is incorrect because while it does mention the impact of technology and globalization on the world of work, it does not capture the full scope of the passage, which also discusses the skills that employees need to develop in order to succeed in this changing world.
Option c is correct- Option c is correct because the passage discusses the changing nature of work and the need for employees to develop new skills in order to succeed. It identifies adaptability, creativity, and emotional intelligence as three key skills that will be in high demand in the years to come.
Option d is incorrect- Option d is incorrect because while it does mention the increasing interconnectedness and competitiveness of the world of work, it does not capture the full scope of the passage, which also discusses the impact of technology and the need for employees to develop specific skills.

Q.53)
Ans) c
Exp) Option c is the correct answer.

The formula would be $n^3 + n$ starting from n=3.

$30 = 3^3 + 3$

$68 = 4^3 + 4$

$130 = 5^3 + 5$

$222 = 6^3 + 6$

$350 = 7^3 + 7$

$520 = 8^3 + 8$

Q.54)

Ans) a

Exp) option a is the correct answer.

Number of ways of selecting 1 question from exercise 7 = c_1^{12}

Number of ways of selecting 1 question from exercise 8 = c_1^{18}

Number of ways of selecting 1 question from exercise 9 = c_1^9

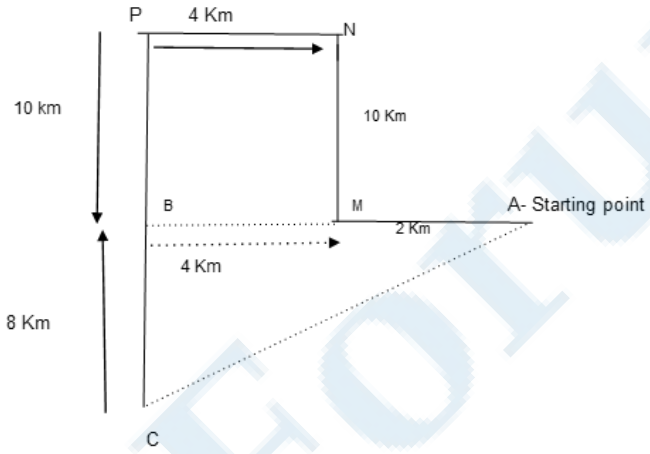
Therefore, total number of ways = $c_1^{12} * c_1^{18} * c_1^9 = 12 * 18 * 9 = 1944$.

Hence, option a is the correct answer.

Q.55)

Ans) d

Exp) Option d is the correct answer.



Starting from point A, passing through the points M, N, and P, Nidhi reaches C.

In right angle triangle ABC, by pythagoras theorem,

$$AC = \sqrt{BC^2 + AB^2} = \sqrt{8^2 + 6^2} = \sqrt{100} = 10 \text{ Km}$$

Statement 1 is incorrect- The distance is 10 Km.

Statement 2 is incorrect- The direction from the starting point is South-West.

Q.56)

Ans) b

Exp) Option b is the correct answer.

Statement 1 is correct: The passage mentions that land degradation, land conversion, and pollution of water bodies are some of the severe environmental externalities associated with mining in India, which could result in a loss of biodiversity and local heritage.

Statement 2 is correct: The passage though explicitly does not mention the prevalence of diseases caused by mining activities in India but it mentions heath related impacts as one of negative social externalities hence it can be considered a correct inference.
Statement 3 is correct: The passage mentions "groundwater depreciation" as an environmental impact of mining, which could potentially lead to increased concentrations of harmful minerals in groundwater.
Statement 4 is incorrect: The passage does not provide information on increasing instances of mine-related accidents in India. Therefore, this statement is incorrect.
Statement 5 is correct: The passage mentions that land degradation and land conversion are some of the severe environmental externalities associated with mining in India, which could result in soil erosion and destruction of agricultural land. Therefore, this statement is correct.

Q.57)
Ans) c
Exp) Option c is the correct answer.
The passage suggests that only when political power and philosophy coincide, meaning when leaders have a philosophical understanding and philosophers engage in leadership, will cities and the human race have respite from troubles. This implies that we need leaders who have a strong foundation in philosophy to create a harmonious society.

Q.58)
Ans) a
Exp) Option a is the correct answer.
Given:
Total number of questions = 75
Marks for every correct answer = 4
Marks deducted for every incorrect answer = 1
Total marks scored = 250
Calculation:
Let the number of incorrect responses be x
=> Number of correct responses = 75- x
According to the question, total marks scored = 250
4 * (75-x) - 1 * (x)= 250
=> 300 - 4*x - x = 250
=> 300 - 5*x = 250
=> x = 10
Hence, option a is correct.

Q.59)
Ans) b
Exp) Option b is the correct answer.
3 girls can be selected out of 5 girls in c_3^5 ways. Since, number of boys to be invited is not given, hence out of 4 boys, he can invite them in 2^4 ways.
Therefore, required number of ways = $c_3^5 \times 2^4 = 10 \times 16 = 160$

Q.60)

Ans) a

Exp) Option a is the correct answer.

Let the present age of Monu be x years and the present age of Tina be y years.
Since, it was 12th wedding anniversary, then according to the question,
their age twelve years back
¾ (x-12) = y-12
=> 3x/4 - 9 = y-12
=> 3x/4 - y = -3
=> 3x - 4y = -12 -------- (i)
Now, their present age,
5x/6 = y
=> 5x = 6 y or 5x - 6y = 0 -------(ii)
On solving equation (i) and (ii),
x=36 and y=30
Hence, present age of Monu = 36. Present age of Tina = 30.
Therefore, only statement 1 is correct.