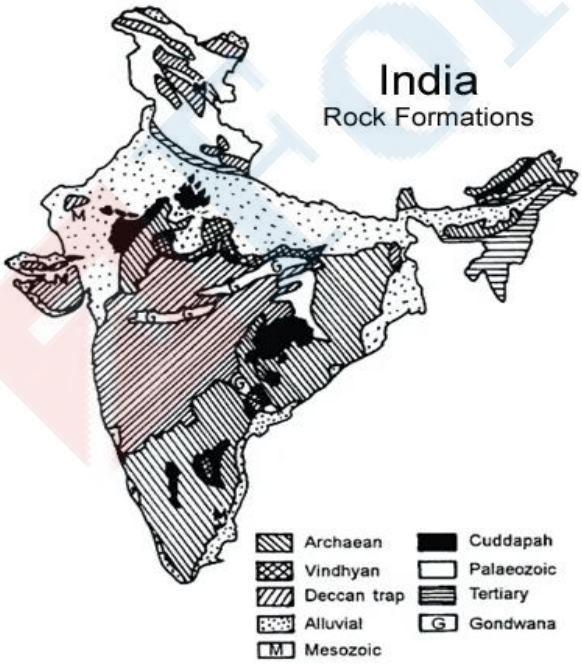
SFG – FRC for CSE 2024 | Geography #2 – Solutions | ForumIAS

Q.1)
Ans) b
Exp) Option (b) is the correct answer.
Statement 1 is incorrect. Main Central Thrust (MCT) Zone: This separates the Higher Himalayas in the north from lesser Himalayas in the south. It has played an important role in the tectonic history of these mountains.
Statement 2 is incorrect. Main Boundary Thrust (MBT) Zone: It is a reverse fault of great dimensions which extends all the way from Assam to Punjab and serves to separate the outer Himalayas from the lesser Himalayas.
Statement 3 is correct. Himalayan Frontal Fault/Thrust (HFF/T): It is a series of reverse faults that demarcates the boundary of the Shivalik of the Himalayan province from the alluvial expanse of the Indo-Gangetic plains.
KB) A type of fault formed when the hanging wall fault block moves up along a fault surface relative to the footwall. Such movement can occur in areas where the Earth's crust is compressed.

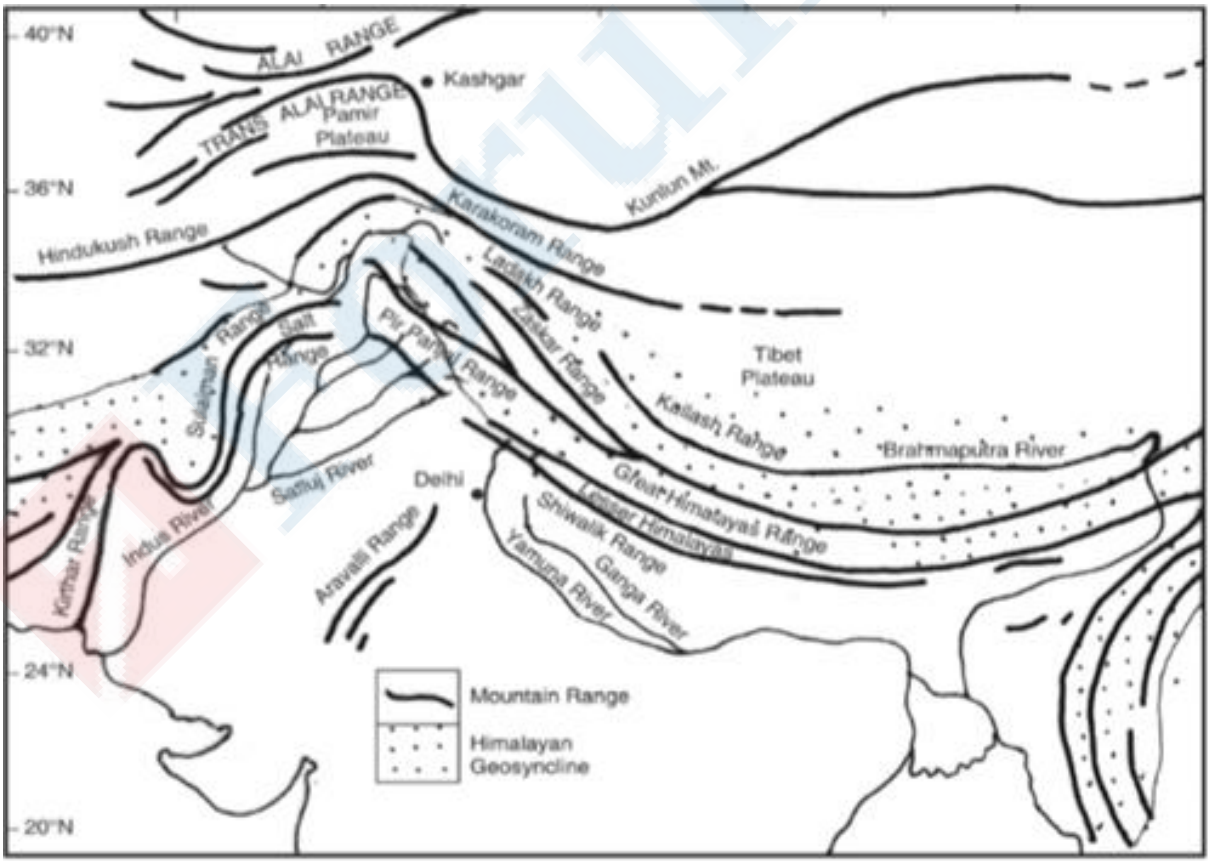
Q.2)
Ans) b
Exp) Option (b) is the correct answer.
Statement 1 is correct. The origin of rocks of Peninsular India is more than 3600 million years old. Before the carboniferous period, it was a part of Gondwanaland.
Statement 2 is incorrect. Peninsular India exhibits a complex system of geological structures. It has some of the oldest rocks of the world from the Precambrian period and some youngest rocks of the Holocene epoch.

Q.3)
Ans) a
Exp) Option (a) is the correct answer.
India can be divided into several divisions such as Archean System, Dharwar System, Cuddapah system, Vindhyan system, Paleozoic,Mesozoic, Gondwana, Deccan Trap, Tertiary and Alluvial.



Rock System in India
Archean rocks, also known as Pre-Cambrian rocks are the oldest rocks of the earth's crust.
The Archean period covers 86.7% of Total geological history of earth and therefore is very significant.
Dharwar system is later than the Archean system but older than the other systems.
Cuddapah System rocks are rich in metamorphic rocks such as sandstone, shale, limestone, quartzite, and slate. It is younger than Dharwar but older than other system.
As the name suggests, these are the major coal deposits of India. This system contains famous Damuda and Panchet series which are famous for coal deposits (discussed below).
The important coal bearing areas of this series are Raniganj, Jharia, Karanpur, and Bokaro of the Damodar basin in Odisha, and the Pench valley in Chhattisgarh and Madhya Pradesh, the jhingurda coal seam (Chhattisgarh).

Q.4)
Ans) c
Exp) Option (c) is the correct answer.
Statement 1 is correct. The Greater Himalayas receives less rainfall as compared to lesser Himalayas and Shiwalik.
Statement 2 is correct. Duars are floodplains and foothills of Himalayas in North-Eastern state Assam and northern part of West Bengal. The altitude of this region varies widely with as low as 90 m and as high as 1,750 m. The similar region in Nepal and North India is termed Terai.
Statement 3 is correct. Western Himalayas is wider than the Eastern Himalayas. It narrows down towards Eastern Himalayas but its altitude increases towards the east.



Physical Division of Himalayas

Q.5)
Ans) b
Exp) Option b is correct.
Magma is composed of molten rock and is stored in the Earth's crust. Lava is magma that reaches the surface through a volcano vent.
Statement 1 is *incorrect*. Acidic lavas are **highly viscous** with a high melting point. Sometimes the lavas are so viscous that they form a lava plug at the crater like that of Mt. Pelée in Martinique They **flow slowly and seldom travel far** before solidifying. Basic Lava are **highly fluid and less viscous.**
Statement 2 is correct. Acidic lavas are light-coloured, of low density, and have a **high percentage of silica**. They **flow slowly and seldom travel far** before solidifying. The resultant volcanic cone is therefore stratified (hence the name **stratovolcano**) and steep-sided.
Statement 3 is correct. Basic lavas are the **hottest lavas**, about 1,000 °C and are **highly fluid.** Due to their high fluidity, they flow readily with a speed of 10 to 30 miles per hour. **They affect extensive areas, spreading out as thin sheets over great distances before they solidify**.
Statement 4 is *incorrect*. Basic Lavas flow out of volcanic vent **quietly and are not very explosive.** But with respect to Acidic Lavas, the **rapid solidifying of lava** in the vent obstructs the flow of the out-pouring lava, resulting in **loud explosions**, throwing out many volcanic **bombs or pyroclasts**

Q.6)
Ans) c
Exp) Option (c) is the correct answer.
Hawaii Islands - in Pacific Ocean is a volcanic archipelago
Galapagos Islands - in South Pacific Ocean is a volcanic archipelago
Reunion Islands - in Indian Ocean has a volcanic origin.
Maldives is a series of coral atolls.

Q.7)
Ans) c
Exp) Option c is correct.
The Spherical shape of the Earth can be explained on the basis of various examples.
Option 1 is correct. When three poles are drilled into equal depth in the ground, the middle pole looks taller than the other two in the extremes. If the earth were to be flatter, all of them would be of equal height. Thus, it indicates that earth is spherical in shape.
Option 2 is correct. Since the sun's rays don't fall with equal intensity over any place on earth, it can be assumed that the surface is not flat. This has resulted in different geographical regions having different times of the day.
Option 3 is incorrect. Interpretation of lunar eclipse (and not solar eclipse) gave the strongest evidence of earth's spherical shape. During the Lunar Eclipse, the shadow of the earth falls on the moon which is round. The shadow has an arc and only a spherical object has the property of casting a circular shadow.
Option 4 is correct. The distant horizon observed from a height such as a cliff or a tower shows a curved horizon. As the height of observation increases the width of the horizon increases and looks much more curved.

Q.8)
Ans) a
Exp) Option (a) is the correct answer.
Statement 1 is correct. The Malda fault gets its name from the Malda district of West Bengal.

Statement 2 is incorrect. The northeastern parts are separated by the Malda fault in West Bengal from the Chotanagpur plateau.

KB) Fault, in geology, a planar or gently curved fracture in the rocks of the Earth's crust, where compressional or tensional forces cause relative displacement of the rocks on the opposite sides of the fracture. Faults range in length from a few centimetres to many hundreds of kilometres, and displacement likewise may range from less than a centimetre to several hundred kilometres along the fracture surface (the fault plane). Faults may be vertical, horizontal, or inclined at any angle. Although the angle of inclination of a specific fault plane tends to be relatively uniform, it may differ considerably along its length from place to place. When rocks slip past each other in faulting, the upper or overlying block along the fault plane is called the hanging wall, or headwall; the block below is called the footwall. The fault strike is the direction of the line of intersection between the fault plane and the surface of the Earth. The dip of the fault plane is its angle of inclination measured from the horizontal.

Q.9)

Ans) b

Exp) Option (b) is the correct answer.

Some of the major differences between Eastern Himalayas and Western Himalayas:

Western Himalayas	Eastern Himalayas
1. Extends till west of River Kali (around 80°E Longitude).	1. This is considered to be ranging from east of the Singalila ranges in Sikkim (88°E Longitudes) to eastern boundaries of Himalayas.
2. Height of the mountains from the plains in this part rises in a number of stages. The high mountain ranges are at a long distance from the plains	2. This part rises abruptly from the plains, thus peaks are not faraway from the plains (Example: Kanchenjunga)
3. Amount of rainfall here is less and is 1/4th of that of Eastern Himalayas.	3. This region receives 4 times more rainfall than western Himalayas. Due to high rainfalls, it is covered with dense forests.
4. *The dominant vegetation in the western Himalayas is Coniferous forests and alpine vegetations. The Natural vegetation reflects the impact of lower rainfall.*	4. Snowline is Higher than Western Himalayas
5. The altitude of the Western Himalayas is higher than the Eastern Himalayas	5. Eastern Himalayas receive more precipitation from south-eastern monsoon in the summers.
6. Snowline is Lower than Eastern Himalayas	6. Much ahead from western Himalayas in terms of Biodiversity and is one of the Biodiversity hotspots
7. Western Himalayas receive more precipitation from northwest in the winters	
8. Less biodiversity in comparison to eastern Himalayas	

Statement 1 is incorrect. The snowline in eastern himalayas is at a higher altitude due to the lower height of the eastern himalayas and the moderating influence of the South west monsoon winds.

Statement 2 is correct. The average height of western Himalayas is higher as the Indo plate is pushing towards the Eurasian plate and causing the height to increase more rapidly.

Q.10)
Ans) a
Exp) Option (a) is the correct answer.
Fold mountains are created where two or more of Earth's tectonic plates are pushed together. At these colliding, compressing boundaries, rocks and debris are warped and folded into rocky outcrops, hills, mountains, and entire mountain ranges.
Fold mountains are created through a process called orogeny. An orogenic event takes millions of years to create a fold mountain, but you can mimic it in seconds. Cover a table with a tablecloth, or place a rug flat on the floor. Now push the edge of the tablecloth or rug—wrinkles will develop and fold on top of each other.
Statement 1 is correct. Fold Mountains are generally associated with increased load of overlying rocks, flow movements in the mantle, magnetic intrusions into crust, and expansion or contraction of some parts of Earth.
Statement 2 is incorrect. Fold Mountains are closely associated with volcanic activities. Best example is Circum-Pacific fold Mountains. Most fold mountains are composed primarily of sedimentary rock and metamorphic rock formed under high pressure and relatively low temperatures. Many fold mountains are also formed where an underlying layer of ductile minerals, such as salt, is present.

Q.11)
Ans) d
Exp) Option (d) is the correct answer.
Extrusive rock from volcanic activities- Granite, diorite and gabbro.
Landforms associated with volcanic activity beneath the earth's surface are sill, dyke, laccolith, phacoliths, laccoliths and batholiths.

Q.12)
Ans) b
Exp) Option b is correct.
Statement 1 is *incorrect*. The upper layer of the Earth's crust is called **lithosphere.** It has 2 parts – upper part is granitic rocks and forms the continents. Its main constituent is **Silica and Aluminium** and is also called SiAl. It has a density of 2.7. The **lower part is denser and is called SiMa [Silica, iron, magnesium].**
Statement 2 is correct. As the **SiAl is lighter than SiMa,** the continents are said to be floating on denser SiMa. The thickness of the crust is about 30 miles.
Statement 3 is *incorrect*. Oceanic crust is mostly **composed of different types of basalts** while **continental crust is mostly composed of different types of granites.** Oceanic crust is thinner as compared to the continental crust. The mean thickness of oceanic crust is 5 km whereas that of the continental is around 30 km.

Q.13)
Ans) d
Exp) Option (d) is the correct answer.
Statement 1 is incorrect. Earthquakes are vibrations of the Earth caused by ruptures and sudden movements of the rocks that have been strained beyond their elastic limits. Himalayan region is very prone to Earthquake. Every year numerous earthquakes are recorded in the Himalayan region, the great plain of India, purvanchal and the islands of Andaman and Nicobar. Most of the earthquakes of high magnitude occurred in the folded mountains of Himalayas. Their frequency is, however, low in the relatively more stable peninsular India, but peninsular India is not free from earthquake.

Statement 2 is incorrect. A volcano is an opening in the crust of the earth, connected by a conduit to an underlying magma chamber from which molten lava, volcanic gases, steam, and pyroclastic materials are ejected. It is usually in the form of a peak which may be cone shaped or dome shaped, depending on the type of volcano and type of material ejected. The main causes of volcanic eruptions are associated with seafloor spreading, plate tectonics and mountain building process. At present, the only active volcanoes in India are at the Barren and Narkondam islands.

Q.14)
Ans) c
Exp) Option (c) is the correct answer.
In geology, a placer deposit or placer is an accumulation of valuable minerals formed by gravity separation from a specific source rock during sedimentary processes. The name is from the Spanish word placer, meaning "alluvial sand". Placer mining is an important source of gold, and was the main technique used in the early years of many gold rushes, including the California Gold Rush. Types of placer deposits include alluvium, eluvium, beach placers, and paleoplacers.
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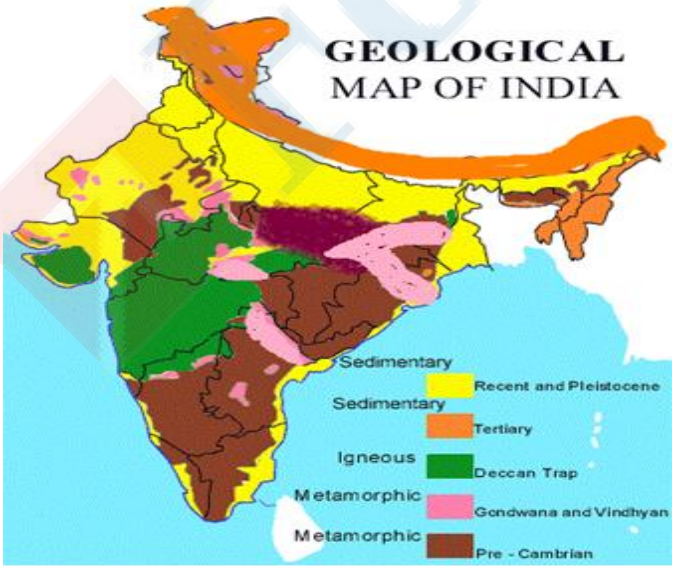
KB) Placer materials must be both dense and resistant to weathering processes. To accumulate in placers, mineral particles must be significantly denser than quartz (whose specific gravity is 2.65), as quartz is usually the largest component of sand or gravel. Placer environments typically contain black sand, a conspicuous shiny black mixture of iron oxides, mostly magnetite with variable amounts of ilmenite and hematite. Valuable mineral components often occurring with black sands are monazite, rutile, zircon, chromite, wolframite, and cassiterite.

Q.15)
Ans) c
Exp) Option (c) is the correct answer.
The rock system in India is divided into 4 major divisions:
1. The Archaean Rock System.
2. The Purana Rock System.
3. The Dravidian Rock System.
4. The Aryan Rock System.



Pair (1) is correctly matched. Rocks formed prior to the Cambrian system are part of the Archaean Rock System. The Archaean rock system includes:

- Archaean Gneisses and Schists and Dharwar system:
- Gneiss - Mineral composition varies from granite to gabbro.
- Schists - mostly crystalline, include mica, talc, hornblende, chlorite, etc.

These rocks are:

- Oldest rocks [preCambrian era] [formed about 4 billion years ago].
- Rocks formed due to solidification of molten magma – the earth's surface was very hot then.
- Known as the 'Basement Complex' [They are the oldest and forms the base for new layers]
- Azoic or unfossiliferous,
- Foliated (consisting of thin sheets),
- Thoroughly crystalline (because they are volcanic in origin),
- Plutonic intrusions (volcanic rocks found deep inside).
- The southern and central part of the indian peninsula are occupied by this system.

Pair (2) is correctly matched. The Purana Rock System includes two divisions: the Cuddapah System and the Vindhyan System.

Pair (3) is correctly matched. The Aryan Rock System includes the Gondwana system, Jurassic system, Deccan trap, Tertiary system and the Quaternary system.

The Tertiary is the most significant period in India's geological history because the Himalayas were born and India's present form came into being in this period.

Q.16)

Ans) c

Exp) Option (c) is the correct answer.

Andaman and Nicobar Islands

This archipelago is composed of 265 big and small islands. The Andaman and Nicobar islands extend from 6° 45′ N to 13° 45′ N and from 92° 10′ E to 94° 15′ E for a distance of about 590 km.

Statement 1 is correct. Most of these islands are made of tertiary sandstone, limestone and shale resting on basic and ultrabasic volcanoes. Some of the islands are fringed with coral reefs. Many of them are covered with thick forests. Most of the islands are mountainous.

In the Arabian Sea, there are three types of islands.

Amindivi Islands (consisting of six main islands of Amini, Keltan, Chetlat, Kadmat, Bitra and Perumal Par).

Laccadive Islands (consisting of five major islands of Androth, Kalpeni, Kavaratti, Pitti and Suheli Par)

Minicoy Island

Lakshadweep Islands: At present these islands are collectively known as Lakshadweep. The Lakshadweep Islands are a group of 25 small islands. They are widely scattered about 200-500 km south-west of the Kerala coast.

Statement 2 is correct. All are tiny islands of coral origin {Atoll} and are surrounded by fringing reefs. The Reunion hotspot is a volcanic hotspot which currently lies under the Island of Reunion in the Indian Ocean. The hotspot is believed to have been active for over 66 million years.

A huge eruption of this hotspot 66 million years ago is thought to have laid down the Deccan Traps and opened a rift which separated India from the Seychelles Plateau.

As the Indian plate drifted north, the hotspot continued to punch through the plate, creating a string of volcanic islands and undersea plateaus.

The Chagos-Laccadive Ridge (Lakshadweep is a part of this ridge) and the southern part of the Mascarene Plateau are volcanic traces of the Reunion hotspot.

The Laccadive Islands, the Maldives, and the Chagos Archipelago are atolls resting on former volcanoes created 60-45 million years ago that subsequently submerged below sea level.

About 45 million years ago the mid-ocean rift crossed over the hotspot, and the hotspot passed under the African Plate.

KB) Hotspot volcanism is a type of volcanism that typically occurs at the interior parts of the lithospheric plates rather than at the zones of convergence and divergence (plate margins). Hotspot volcanism explains the so-called anomalous volcanism – the type that occurs far from plate boundaries, like in Hawaii and Yellowstone, or in excessive amounts along mid-ocean ridges, as in Iceland. Well known hotspots include the Hawaiian Hotspot, the Yellowstone Hotspot, the Reunion Hotspot.

Q.17)

Ans) d

Exp) Option (d) is the correct answer.

Depending upon the intensity and frequency of the earthquakes, the whole country can be divided into three broad categories:

Himalayan zone

The area's most prone to earthquakes in India are the fold mountain ranges of the Himalayan zone. The states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Bihar, Bihar-Nepal border and Northeastern states, especially Assam fall in this zone. Primarily due to plate tectonics.

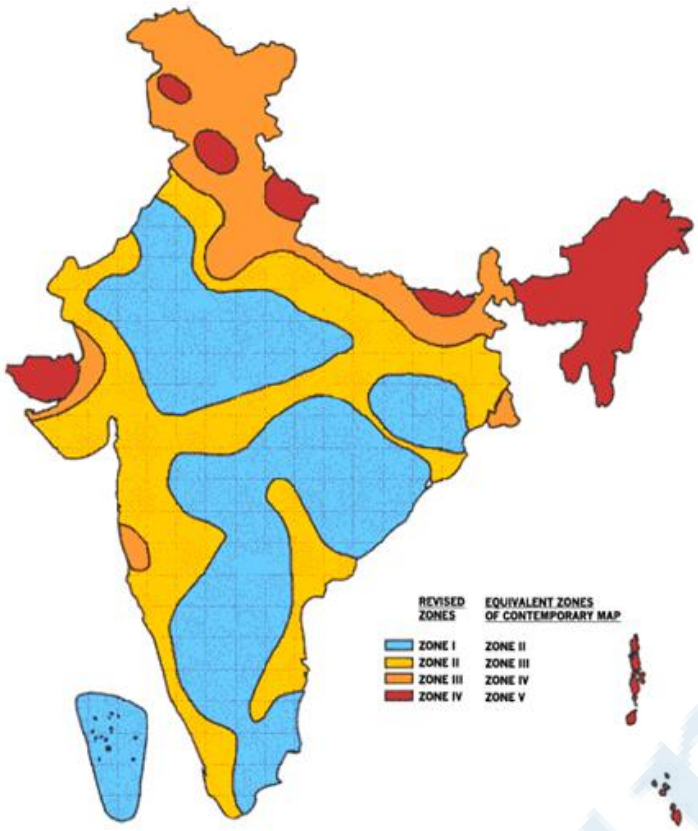
Indo-Gangetic zone

To the south of Himalayan zone and running parallel to its the Indo-Gangetic zone. Most of the earthquakes striking this zone are of moderate intensity. However, the earthquakes are more haramful due to the presence of a large population.

The Peninsular zone

The peninsular India has presumably remained a stable landmass and only a few earthquakes have been experienced in this region.

KB) Earthquake - prone areas of the country have been identified on the basis of scientific inputs relating to seismicity, earthquakes occurred in the past and tectonic setup of the region. Based on these inputs, Bureau of Indian Standards, has grouped the country into four seismic zones, viz. Zone II, III, IV and V. Of these, Zone V is seismically the most active region, while zone II is the least. Broadly, Zone - V comprises entire northeastern India, parts of Jammu and Kashmir, Himachal Pradesh, Uttaranchal, Rann of Kutch in Gujarat, part of North Bihar and Andaman & Nicobar Islands. Zone - IV covers remaining parts of Jammu and Kashmir and Himachal Pradesh, National Capital Territory (NCT) of Delhi, Sikkim, Northern Parts of Uttar Pradesh, Bihar and West Bengal, parts of Gujarat and small portions of Maharashtra near the west coast and Rajasthan. Zone – III comprises Kerala, Goa, Lakshadweep islands, remaining parts of Uttar Pradesh, Gujarat and West Bengal, Parts of Punjab, Rajasthan, Madhya Pradesh, Bihar, Jharkhand, Chhattisgarh, Maharashtra, Orissa, Andhra Pradesh, Tamilnadu and Karnataka. Zone - II covers the remaining parts of the country.

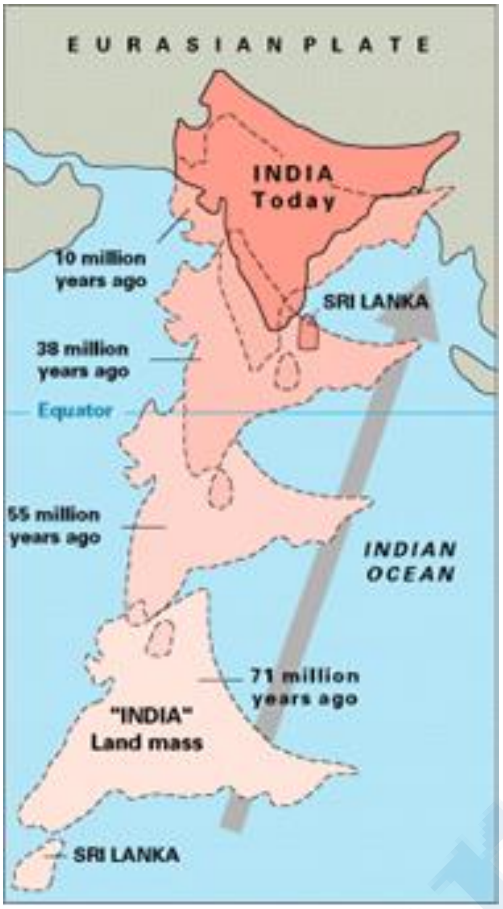


Q.18)
Ans) b
Exp) Option b is correct
Statement 1 is correct. The concept of seafloor spreading was put forward by Harry Hess (1961), an American geologist.
Statement 2 is incorrect. The newly formed seafloor (oceanic crust) gradually moves away from the ridge, and its place is taken by an even newer seafloor and the cycle repeats. With time, older rocks are spread farther away from the spreading zone while younger rocks are found nearer to the spreading zone, so the age of the rocks increases as one moves away from the oceanic ridge.
Statement 3 is correct. The magnetic studies have revealed that the ocean floor consists of parallel bands of oceanic crust which have alternating magnetic polarity. These magnetic bands are symmetric and are mirrored around the mid-oceanic ridge. This had happened because the new rocks are formed near the ridge, while the older rocks, which formed millions of years ago when the magnetic field was reversed, have been pushed farther away. Hence, this further explains the seafloor spreading.

Q.19)
Ans) a
Exp) Option a is correct
Statement 1 is correct. India was a large island situated off the Australian coast, in a vast ocean. The Tethys Sea separated it from the Asian continent till about 225 million years ago. India is supposed to have started her northward journey about 200- 100 million years ago at the time when Pangaea broke. India collided with Asia about 40-50 million years ago causing rapid uplift of the Himalayas.

Statement 2 is incorrect. Indian plate is made up of denser material compared to the Eurasian Plate. Indian plate thus started to get sub-ducted under Eurasian plate causing lateral compression of marine sediments and eventually raising Himalayas.

Knowledge Base: Movement of Indian plate and its collision with Eurasian plate.



Q.20)

Ans) b

Exp) Option (b) is the correct answer.

The Himalayan region is a high seismic zone yet it is conspicuous by the absence of volcanoes. Some of the reasons for it are:

The Eurasian plate was partly crumpled and buckled up above the Indian plate but due to their low density/high buoyancy neither continental plate could be subducted. This caused the continental crust to thicken due to folding and faulting by compressional forces pushing up the Himalaya and the Tibetan Plateau. The continental crust here is twice the average thickness at around 75 km. The thickening of the continental crust marked the end of volcanic activity in the region as any magma moving upwards would solidify before it could reach the surface Continental crust is less dense than Oceanic crust but is more thicker.

Q.21)

Ans) b

Exp) Option (b) is the correct answer.

Statement 1 is incorrect. The main difference between a geyser and a hot spring is that a geyser is plugged with an obstruction near the opening of the spout and a hot spring is allowed to flow freely. Both geysers and hot springs get their water from rain and snow that melts and seeps into the ground, which is then heated by magma.
Statement 2 is correct. Hot springs are where water is constantly boiling inside a hole or heated pond. Geyser is a hole where water is always rising into the air and then rising up again at an approximate time repeatedly.
Statement 3 is incorrect. Like many other natural phenomena, geysers are not unique to planet Earth. Jet-like eruptions, often referred to as cryo geysers, have been observed on several of the moons of the outer solar system. Due to the low ambient pressures, these eruptions consist of vapor without liquid; they are made more easily visible by particles of dust and ice carried aloft by the gas. Water vapor jets have been observed near the south pole of Saturn's moon Enceladus, while nitrogen eruptions have been observed on Neptune's moon Triton.

Q.22)
Ans) d
Exp) Option d is correct
Statement 1 is incorrect. Festoons are group of island Arcs which forms an archipelago in the shape of a loop around the edge or the mainland, marking the continuation of continent and mountain ranges. e.g., the East Indies, the Aleutian Islands, Ryukyu Islands, Kurile Islands and other island arcs of the Pacific coasts.
Statement 2 is incorrect. Madagascar is a continental island (not volcanic island) in Indian Ocean region. It is a part of Gondwana supercontinent. Reunion and Mauritius are important volcanic islands of Indian ocean.
It got separated as Madagascar–Antarctica–India landmass from the Africa–South America landmass around 135 million years ago. Madagascar later splits from India about 88 million years ago during the late Cretaceous period allowing plants and animals on the island to evolve in relative isolation.

Q.23)
Ans) c
Exp) Option (c) is the correct answer.
India is rich in underground water resources. Its spatial distribution is however uneven. The underground water resource is a function of geological structure, topography, slope, precipitation, runoff, soils and hydrological conditions of a region. India is divided into 8 underground water provinces:

- The Pre-Cambrian Crystalline Province
- The Pre-Cambrian Sedimentary Rocks Province
- The Gondwana Sedimentary Province
- The Deccan Trap Province
- The Cenozoic Sedimentary Province
- The Ganga Brahmaputra Alluvial Province
- The Himalayan Province
- The Cenozoic Fault Basin

Statement 1 is correct. The Himalayan province is structurally complex. In general, it is deficient in underground water except the intermontane valleys like the Dun, Kashmir, Kangra, Kullu and Manali valleys. This region has numerous springs.
Statement 2 is correct. The Cenozoic Sedimentary Province includes the coastal areas of Andhra Pradesh, Tamil Nadu, Kerala and Gujarat.The sandstones of the tertiary period in these regions are rich in underground water resources.

Q.24)

Ans) c

Exp) Option c is correct.

The most widely accepted theory of planetary formation, known as the nebular hypothesis, maintains that 4.6 billion years ago, the Solar System formed from the gravitational collapse of a giant molecular cloud which was light years across. Several stars, including the Sun, formed within the collapsing cloud. The gas that formed the Solar System was slightly more massive than the Sun itself. Most of the mass collected in the centre, forming the Sun; the rest of the mass flattened into a protoplanetary disk, out of which the planets and other bodies in the Solar System formed.

Q.25)

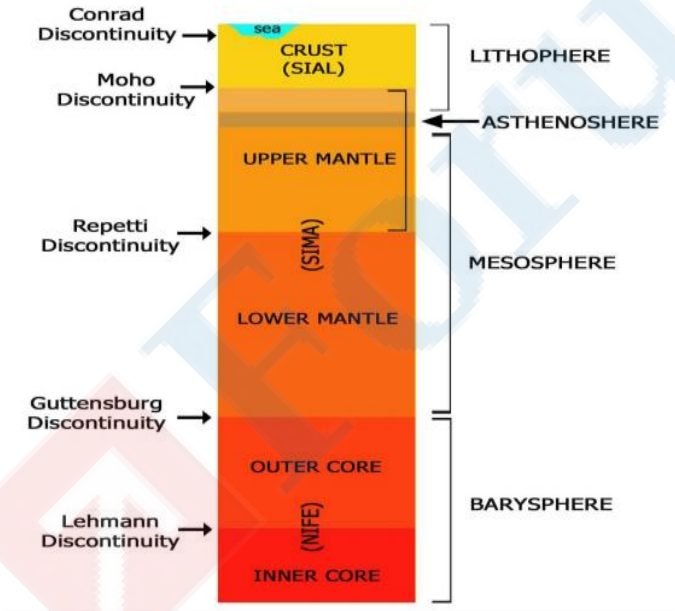
Ans) a

Exp) Option a is correct.

Earth's interior is made of different kinds of materials. Each of those materials are different from each other by their physical and chemical properties, such as temperature, density etc. Unique layers are there according to their characteristics inside the earth. All those layers are separated from each other through a transition zone. These transition zones are called discontinuities.

There are five discontinuities inside the earth.

1) **Conrad Discontinuity**: Transition zone between SIAL and SIMA.
2) **Mohorovicic Discontinuity**: Transition zone between the Crust and Mantle.
3) **Repiti Discontinuity**: Transition zone between Outer mantle and Inner mantle.
4) **Gutenberg Discontinuity**: Transition zone between Mantle and Core.
5) **Lehman Discontinuity**: Transition zone between Outer core and Inner core.



Q.26)

Ans) c

Exp) Option c is correct.

The earth's radius is 6,370 km. It is very difficult to reach the centre of the earth and make observations or collect samples of the material. Thus, most of our knowledge about the interior of the earth is largely based on estimates and inferences.

- Indirect Sources of information about the interior of the earth:
- The material and the structure observed in the meteors are similar to that of the earth. They are solid bodies developed out of materials same as, or similar to, our planet. Hence, this becomes yet another source of information about the interior of the earth.
- Another source of indirect information is gravitation force (g). The gravitation force (g) is not the same at different latitudes on the surface. It is greater near the poles and less at the equator. This is because of the distance from the centre at the equator being greater than that at the poles. The gravity values also differ according to the mass of material. The uneven distribution of mass of material within the earth influences this value. The reading of the gravity at different places is influenced by many other factors. These readings differ from the expected values. Such a difference is called gravity anomaly. Gravity anomalies give us information about the distribution of mass of the material in the crust of the earth.
- Seismic activity is one of the most important indirect sources of information about the interior of the earth and provides a complete picture of the layered interior.

Volcanic eruption and rocks from the mining areas forms direct source of obtaining information about the interior of the earth.

Q.27)
Ans) c
Exp) Option c is correct.
Statement 1 is correct. The outermost solid part of earth is called crust. There are two very different types of crust, each with its own distinctive physical and chemical properties. Continental crust rises higher on the mantle than oceanic crust because it is thick and has relatively low density. The thickness of the crust varies under the oceanic and continental areas. Oceanic crust is thinner as compared to the continental crust. The mean thickness of oceanic crust is 5 km whereas that of the continental is around 30 km.
Statement 2 is correct. Oceanic crust is composed of dense material such as iron magnesium silicate igneous rocks (like basalt), the continental crust is less dense and composed of sodium potassium aluminium silicate rocks, like granite.

Q.28)
Ans) b
Exp) Option b is correct.
Statement 1 is incorrect. P-waves travel through gaseous, liquid and solid materials and S-waves can travel only through solid materials. P-waves are first to arrive, and S-waves arrive at the surface with some time lag.
Statement 2 is correct. P-waves and S-waves move or propagate and cause vibration in the body of the rocks through which they pass. P-waves vibrate parallel to the direction of the waves. This exerts pressure on the material in the direction of the propagation. As a result, it creates density differences in the material leading to stretching and squeezing of the material. S-waves vibrate perpendicular to the direction of propagation. The direction of vibrations of S-waves is perpendicular to the wave direction in the vertical plane. Hence, they create troughs and crests in the material through which they pass

Q.29)
Ans) d
Exp) Option d is correct.
Earthquake is a natural hazard. The following are the immediate hazardous effects of earthquake:

(a) Ground Shaking (b) Differential ground settlement (c) Land and mud slides (d) Soil liquefaction (e) Ground lurching (f) Avalanches (g) Ground displacement (h) Floods from dam and levee failures (i) Fires (j) Structural collapse (k) Falling objects (l) Tsunami

The first six listed above have some bearings upon landforms, while others may be considered the effects causing immediate concern to the life and properties of people in the region. The effect of tsunami would occur only if the epicentre of the tremor is below oceanic waters and the magnitude is sufficiently high.

Q.30)

Ans) c

Exp) Option c is correct

Statement 1 is correct. In general terms, the endogenic forces are mainly land building forces and the exogenic processes are mainly land wearing forces.

The ultimate source of energy behind endogenic movements is earth's internal heat which is a result of mainly radioactive decay. Differences in temperature and pressure (temperature gradients or geothermal gradients and pressure gradients) among various layers of the earth give rise to density differences and these density differences give rise to conventional currents. The Earth's rotation (Coriolis effect) can influence where convection currents travel. Thus, the movement of the lithospheric plates due to the convectional currents is the cause behind endogenic movements.

Statement 2 is correct. Diastrophism and volcanism are endogenic geomorphic processes since they help in the building of newer landforms on earth.

All processes that move, elevate or build up portions of the earth's crust are collectively referred to as diastrophism. They include: (i) orogenic processes that help in mountain building through process of folding of the crust; (ii) epeirogenic processes involving uplifting of the earth's crust; (iii) earthquakes (iv) plate tectonics involving horizontal movements of plates of the earth's crust.Thus there is deformation of the Earth's crust.

Knowledge Base: Geomorphic processes refer to the endogenic and exogenic forces causing physical stresses and chemical actions on earth materials and bringing about changes in the configuration of the surface of the earth.

Q.31)

Ans) c

Exp) option c is correct

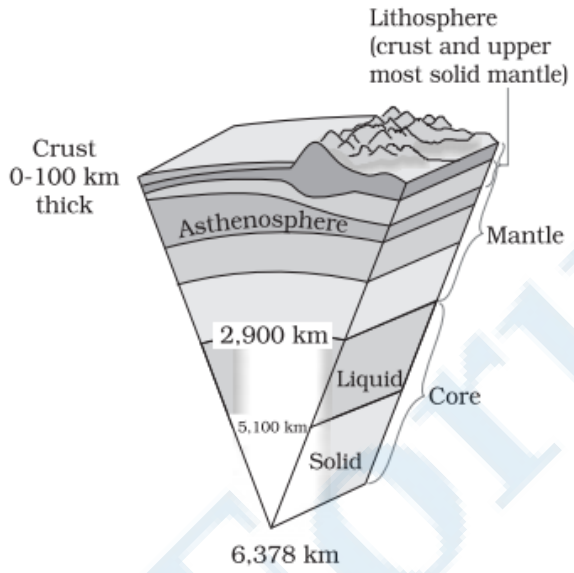
It is generally believed that the formation of moon, as a satellite of the earth, is an outcome of 'giant impact' or what is described as "the big splat". A body of the size of one to three times that of mars collided into the earth sometime shortly after the earth was formed. It blasted a large part of the earth into space. This portion of blasted material then continued to orbit the earth and eventually formed into the present moon about 4.44 billion years ago.

Q.32)

Ans) c

Exp) Option c is correct.

The asthenosphere is partially molten upper mantle material that behaves plastically and can flow. It is from this that the molten rock materials find their way to the surface. Asthenosphere is the highly viscous, mechanically weak, and ductile region of the upper mantle of Earth. It lies below the lithosphere, at depths between approximately 80 and 200 km (50 and 120 miles) below the surface.



The lithosphere is the outermost mechanical layer, which behaves as a brittle, rigid solid. The lithosphere is about 100 kilometres thick.

Oceanic crust is composed of magma that erupts on the seafloor to create basalt lava flows or cools deeper down to create the intrusive igneous rock gabbro.

The portion of the interior beyond the crust is called the mantle. The upper portion of the mantle is called asthenosphere.

Q.33)

Ans) b

Exp) Option b is correct.

Statement 1 is correct: Jovian means Jupiter-like. Most of them are much larger than the terrestrial planets and have thick atmosphere, mostly of helium and hydrogen.

Jovian planets have formed due to the effect of solar winds. The solar wind was most intense nearer the sun; so, it blew off lots of gas and dust from the terrestrial planets. The solar winds were not all that intense to cause similar removal of gases from the Jovian planets.

Statement 2 is incorrect: All the planets were formed in the same period sometime about 4.6 billion years ago. Our Solar system consists of eight planets. The nebula from which our Solar system is supposed to have been formed, started its collapse and core formation some time 5-5.6 billion years ago and the planets were formed about 4.6 billion years ago. Our solar system consists of the sun (the star), 8 planets, 63 moons, millions of smaller bodies like asteroids and comets and huge quantity of dust-grains and gases.
Statement 3 is correct: All four jovian planets have rings, although only Saturn's rings are easily visible from Earth. Rings are composed of countless small pieces of rock and ice, each orbiting its planet like a tiny moon. The rings look flat because the particles all orbit in essentially the same plane. The rings are located closer to the planets than any of their moderately sized or large moons, but the inner edge of the rings is still well above the planet's cloud top.

Q.34)
Ans) c
Exp) Option c is correct.
The present composition of earth's atmosphere is chiefly contributed by nitrogen and oxygen. There are three stages in the evolution of the present atmosphere:
Statement 1 is correct. Solar Winds: The first stage is marked by the loss of primordial atmosphere. The early atmosphere, with hydrogen and helium, is supposed to have been stripped off as a result of the solar winds.
Statement 2 is correct. During the cooling of the earth, gases and water vapour were released from the interior solid earth. This started the evolution of the present atmosphere. The early atmosphere largely contained water vapour, nitrogen, carbon dioxide, methane, ammonia and very little of free oxygen. The process through which the gases were outpoured from the interior is called degassing.
Statement 3 is correct.
Around 2,500-3,000 million years before the present, the process of photosynthesis got evolved. Life was confined to the oceans for a long time. Oceans began to have the contribution of oxygen through the process of photosynthesis.
Statement 4 is incorrect. It is through the process of differentiation that the earth forming material got separated into different layers. It has not influenced the evolution of atmosphere on the earth.

Q.35)
Ans) b
Exp) Option (b) is the correct answer.
The Himalayas are the youngest mountain chain in the world.
Himalayan mountains have come out of a great geosyncline called the Tethys Sea and that the uplift has taken place in different phases. During the Permian Period (250) million years ago, there was a supercontinent known as Pangaea. Its northern part consisted of the present-day North America and Eurasia (Europe and Asia) which is called as Laurasia or Angaraland or Laurentia. The southern part of Pangaea consisted of present-day South America, Africa, South India, Australia and Antarctica. This landmass was called Gondwanaland. In between Laurasia and Gondwanaland, there was a long, narrow and shallow sea known as the Tethys Sea (all this was explained earlier in Continental Drift Theory). There were many rivers which were flowing into the Tethys Sea (some of the Himalayan rivers were older than the Himalayas themselves. We will study this in Antecedent and Subsequent Drainage). Sediments were brought by these rivers and were deposited on the floor of the Tethys Sea.
Statement 1 is incorrect. Majority of the scientists believe that these sediments were subjected to powerful compression due to the northward movement of the Indian Plate, however one cannot deny the

possibility of Southward movement of the Angaraland or movement of both the plates towards each other.
Statement 2 is correct. The Himalayan rivers are in their youthful stage and have been rejuvenated (make or cause to appear younger) in recent times. This shows that the Himalayan Landmass is rising, keeping the rivers in the youth stage for a long time.

Q.36)
Ans) b
Exp) Option b is correct.
Statement 1 is correct. According to The Big Bang Theory, in the beginning, all matter forming the universe existed in one place in the form of a "tiny ball" (singular atom) with an unimaginably small volume, infinite temperature and infinite density.
Statement 2 is incorrect. Big Bang Theory states that universe is constantly expanding. An alternative to this was Hoyle's concept of steady state. It considered the universe to be roughly the same at any point of time. However, with greater evidence becoming available about the expanding universe, scientific community at present favours argument of expanding universe.
Statement 3 is correct. At the Big Bang the "tiny ball" exploded violently. This led to a huge expansion. As it grew, some energy was converted into matter. Thereafter, the expansion has slowed down. Within first three minutes from the Big Bang event, the first atom began to form. Within 300,000 years from the Big Bang, temperature dropped to 4,500K (Kelvin) and gave rise to atomic matter. The universe became transparent.

Q.37)
Ans) d
Exp) Option d is correct.
Statement 1 is correct. Shield volcanoes are mostly made up of basalt, a type of lava that is very fluid. This allows the lava to flow to larger distances, thereby making them largest of all the volcanoes in the world. Thus, they are not steep.
Statement 2 is correct. The Hawaiian volcanoes are the most famous examples of shield volcanoes. Mauna Loa, in the state of Hawaii (USA) is an active shield volcano.
Knowledge Base: Shield volcanoes are characterized by low-explosivity. However, if water gets into the vent, upcoming lava then develops into cinder cone and they become explosive.

Q.38)
Ans) b
Exp) Option b is correct
The earthquake events are scaled either according to the magnitude or intensity of the shock.
Mercalli intensity scale (or more precisely the Modified Mercalli intensity scale) is a scale to measure the intensity of earthquakes. The intensity scale is named after Mercalli, an Italian seismologist. The intensity scale takes into account the visible damage caused by the event. The range of intensity scale is from 1-12.
The magnitude scale is known as the Richter scale. The magnitude relates to the energy released during the quake. The magnitude is expressed in numbers, 0-10.
Barometer is a scientific instrument that is used to measure air pressure in a certain environment.
Seismograph is an instrument used to detect and record earthquakes. Generally, it consists of a mass attached to a fixed base. During an earthquake, the base moves and the mass does not.

Q.39)

Ans) c

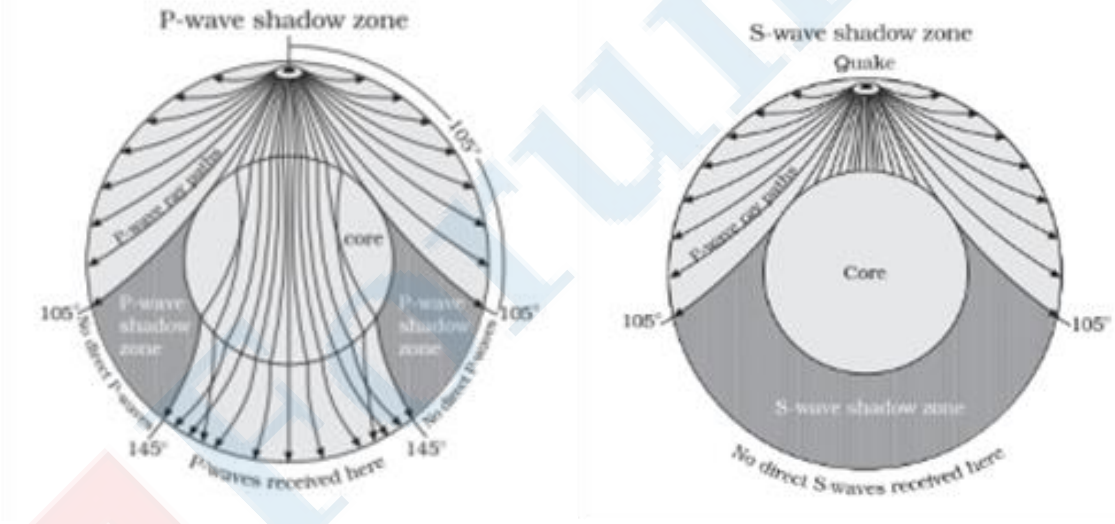
Exp) Option c is correct.

Statement 1 is correct. There are two types of body waves. They are called P and S-waves. P-waves also called as compressional waves as they produce rarefaction and compression when travelling through the medium.

P-waves move faster and are the first to arrive at the surface and hence are used to detect earthquakes. The P-waves are similar to sound waves. They can travel through gaseous, liquid and solid materials and travel in longitudinal direction.

Statement 2 is correct. S-waves are also called as transverse waves or shear waves or distortional waves. They are analogous to water ripples or light waves. Transverse waves or shear waves mean that the direction of vibrations of the particles in the medium is perpendicular to the direction of propagation of the wave. Hence, they create troughs and crests in the material through which they pass (they distort the medium).

Statement 3 is correct.Shadow zone is defined as that area where these waves are not detected due to their inability to reach there depending on their characteristic features. The zone between 105° and 145° from epicentre was identified as the shadow zone for both the types of waves. S-waves travel in a transverse direction. The entire zone beyond 105° does not receive S-waves and is shadow zone for S-waves. Differences in arrival times, waves taking different paths than expected (due to refraction) and absence of the seismic waves in certain regions called as shadow zones, allow mapping of the Earth's interior.



Knowledge Base: Surface waves result in earthquakes on the surface of the earth. The direction and velocity of waves depend on the density of the earth. Just like body waves, surface waves are also of two types - Rayleigh (R) waves and Love (L) waves.

Q.40)

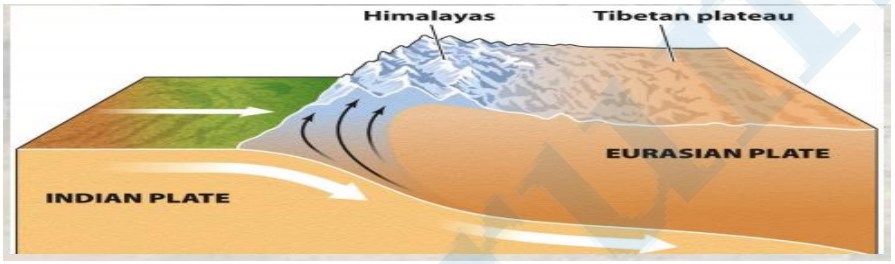
Ans) a

Exp) Option a is correct.

Pair 1 is incorrectly matched. Composite Volcanoes are characterized by the eruption of a cooler and viscous lava. These volcanoes often result in explosive eruptions.

Pair 2 is correctly matched. Caldera volcanoes are the most explosive of the earth's volcanoes. They are explosive that when they erupt, they tend to collapse on themselves. These collapsed depressions are called calderas.
Pair 3 is incorrectly matched. The flood basalt provinces form as a result of outpouring of highly fluid lava that flows for long distances.
Knowledge Base:
Some of the most conspicuous and beautiful mountains in the world are composite volcanoes, including Mount Fuji in Japan, Mount Cotopaxi in Ecuador, Mount Shasta in California.
The Yellowstone Caldera in the Yellowstone National Park in the US is famous example of Caldera volcano.
The Deccan Traps in India, presently covering most of the Maharashtra plateau, are a type of flood basalt province.

Q.41)
Ans) b
Exp) Option b is correct.
Statement 1 is correct. The earthquakes in the Himalayan region are caused by the tectonic collision as a result of the convergence of the Indian plate and Eurasian plate. The Indian plate has been subducting under the Eurasian plate, giving rise to a series of underground faults, running roughly north-west to south-east along the line of collision. The slip events along these faults cause earthquakes in the Himalayan region.



Statement 2 is incorrect. Based on the seismic history, the country has been divided into four seismic zones- Zone II, III, IV and V. The current division of earthquake hazard zones does not use Zone 1; thus, no area of India has been classified as Zone 1.
Statement 3 is correct. Bureau of Indian Standards does the seismic mapping of the country. It has given four seismic zones- Zone II, III, IV and V.
Knowledge Base: The vibrations from an earthquake are classified as P and S waves. P waves are first to be detected by seismograph and are longitudinal waves. S waves are transverse waves that are detected afterwards. While P waves can travel through solid and liquid medium, S waves can travel only through solid medium.

Q.42)
Ans) b
Exp) Option b is correct.
Statement 1 is Incorrect. The earthquake events are scaled either according to the magnitude or intensity of the shock. The magnitude scale is known as the Richter scale. The magnitude relates to the energy released during the quake. The magnitude is expressed in absolute numbers, 0-10. The Richter Scale is a base-ten logarithmic scale. In other words, an earthquake of magnitude 8 is not twice as great as an earthquake of magnitude 4 but 10,000 times as great.
Statement 2 is correct. The intensity scale called the Mercalli scale, takes into account the visible damage caused by the event. The range of intensity scale is from 1-12.

Statement 3 is correct. The point where the energy during the earthquake is released is called the focus or hypocenter of an earthquake. The energy waves travelling in different directions reach the surface. The point on the surface, nearest to the focus, is called epicentre. It is the first one to experience the waves. It is a point directly above the focus.
Knowledge Base: The earthquake's magnitude is determined using the logarithm of the amplitude (height) of the largest seismic wave calibrated to a scale by a seismograph. A seismograph, or seismometer, is an instrument used to detect and record earthquakes.

Q.43)
Ans) b
Exp) Option b) is correct.
Statement 1 is Incorrect: The elements in the earth's crust are rarely found exclusively. They are usually combined with other elements to make various substances. These substances are recognized as minerals.
Statement 2 is correct:Oxygen is found in highest proportion (46.6%) in Earth's crust. Next comes Silicon (27.72%), Aluminium (8.13%), Iron (5%) and Calcium (3.63%).
Knowledge Base: Chemical Composition of the Earth: Iron (34.6%), Oxygen (29.5%), Silicon (15.2%), Magnesium (12.7%), Nickel (2.4%) and Sulphur (1.9%).

Q.44)
Ans) b
Exp) Option b is correct
Pair 1 is correctly matched. A batholith is a huge mass of igneous rocks usually granite, which after removal of the overlying rocks form a massive and restaurant upland region. Example - Wicklow mountains of Ireland
Pair 2 is correctly matched. Laccolith is an igneous mound with a dome shaped upper surface and a level base fed by a pipe-like conduit from below. Example - Henry Mountains in Utah, USA
Pair 3 and pair 4 are *Incorrectly* matched. Sills are near horizontal bodies of the intrusive igneous rocks along the bedding planes of sedimentary rocks. If a sill is very thin, it is called a SHEET. Example - Great Whin Sill of N.E. England.
Dykes are vertical intrusions of molten magma as narrow walls of igneous rocks. Example - Cleveland Dyke of Yorkshire England.
All the above are examples of intrusive volcanic landforms.
Extrusive landforms include the various types of volcanoes that exist on the earth.

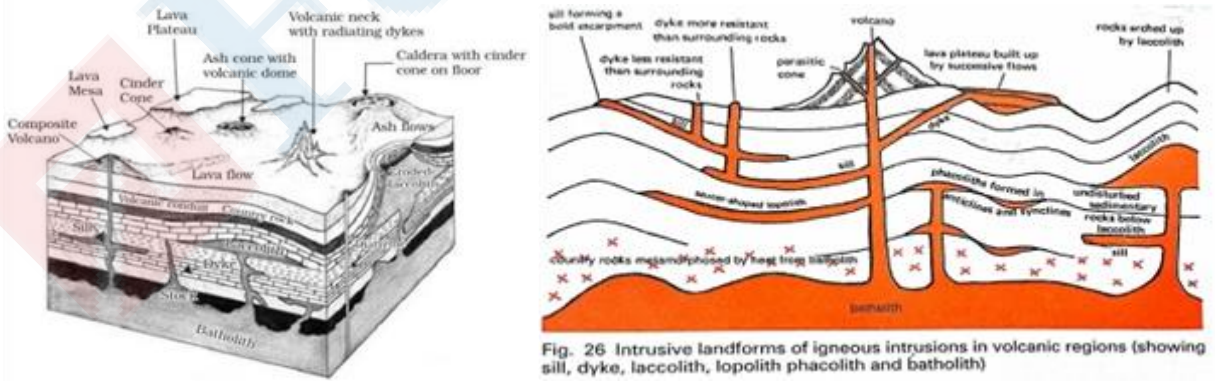


Fig. 26 Intrusive landforms of igneous intrusions in volcanic regions (showing sill, dyke, laccolith, lopolith phacolith and batholith)

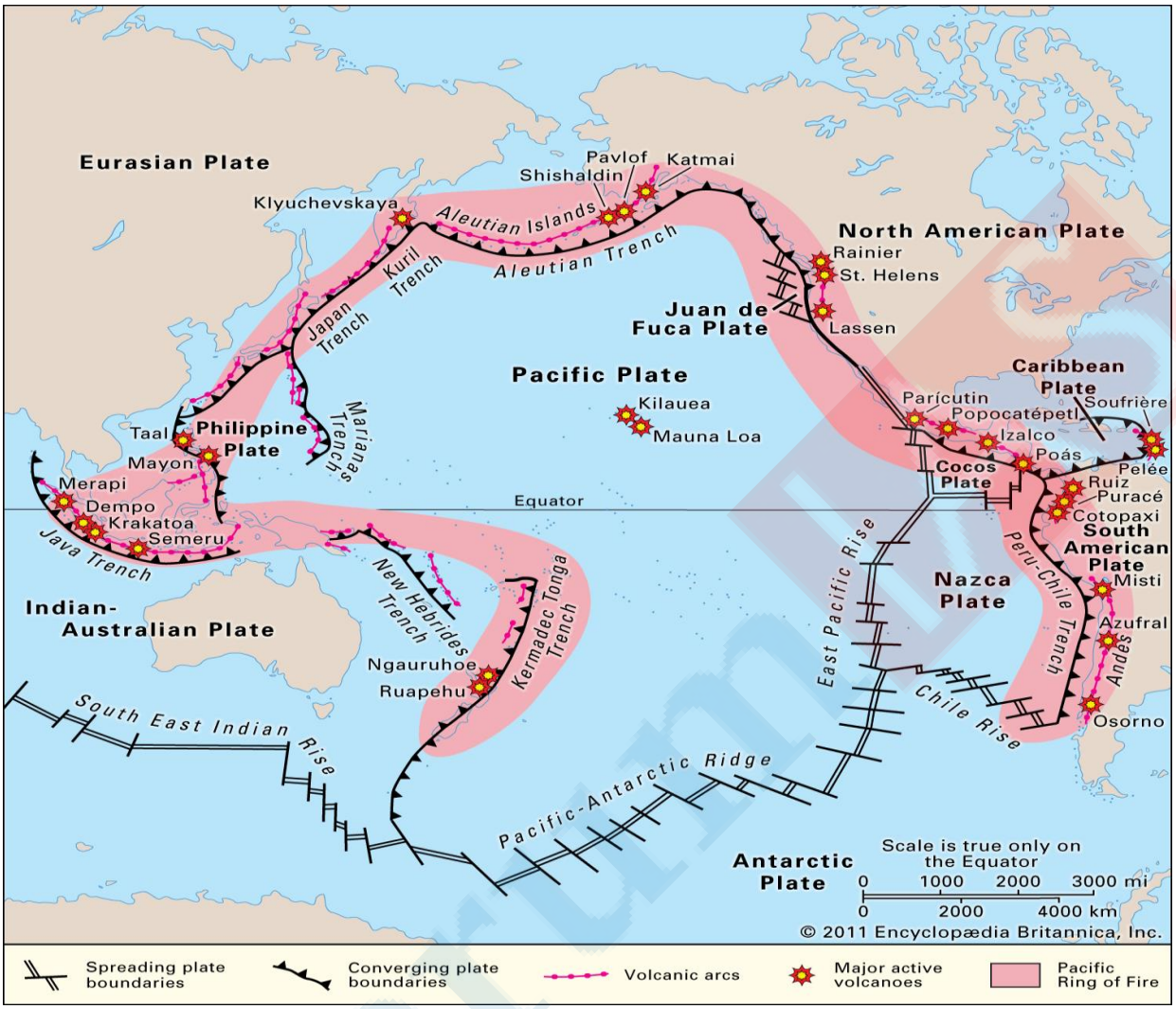
Knowledge Base: The lava that is released during volcanic eruptions on cooling develops into igneous rocks. The cooling may take place either on reaching the surface or also while the lava is still in the crustal portion. Depending on the location of the cooling of the lava, igneous rocks are classified as

volcanic rocks (cooling at the surface) and plutonic rocks (cooling in the crust). The lava that cools within the crustal portions assumes different forms. These forms are called **intrusive forms**.

Q.45)
Ans) b
Exp) Option b is correct.
Statement a is correct. The mid-ocean ridge system is a continuous range of underwater volcanoes. There is a system of mid-ocean ridges more than 70,000 km long that stretches through all the ocean basins. The central portion of this ridge experiences volcanic eruptions.
Statement b is incorrect. Mid-ocean ridges occur along divergent plate boundaries, where new ocean floor is created as the Earth's tectonic plates spread apart.
Statement c is correct. Two well-studied mid-ocean ridges within the global system are the Mid-Atlantic Ridge and the East Pacific Rise.
Statement d is correct. The rocks equidistant on either side of the crest of mid-oceanic ridges show similarities in terms of period of formation, chemical compositions and magnetic properties. Rocks closer to the mid-oceanic ridges have normal polarity and are the youngest. The age of the rocks increases as one moves away from the crest. Thus, the mapping of the ocean floor and understanding of the mid-ocean ridges corroborate the sea floor spreading theory.

Q.46)
Ans) b
Exp) Option b) is correct.
Statement 1 is Incorrect: Igneous –in Latin means 'Fire'.Igneous Rocks aresolidified form of magma and lava.When magma in its upwardmovement cools and turns into solid form it iscalled igneous rock. The process of cooling andsolidification can happen in the earth's crustor on the surface of the earth.Granite, gabbro, pegmatite,basaltand tuff are some ofthe examples of igneous rocks.
Statement 2 is correct:Sedimentary rocks are formed from sediments transported by exogenous agencies. These sediments are depositedin the form of layers and turn into rocksthrough compaction. This process is known as lithification. Sedimentary rocks are also called stratified rocks. Sandstone, conglomerate, limestone, shale, loess are examples of Sedimentary rock.
Statement 3 is correct:The word metamorphic means 'change of form'. Metamorphic rocksform under the action of pressure,volume and temperature changes.Metamorphism is a process by which alreadyconsolidated rocks undergo recrystallization and reorganisation of materials within originalrocks.Marble and Gneiss are examples of these rocks.Knowledge Base: Petrology is science of rocks. A petrologiststudies all aspects of rocks i.e.mineralcomposition, texture, structure,origin, occurrence, alteration andrelationship with other rocks.

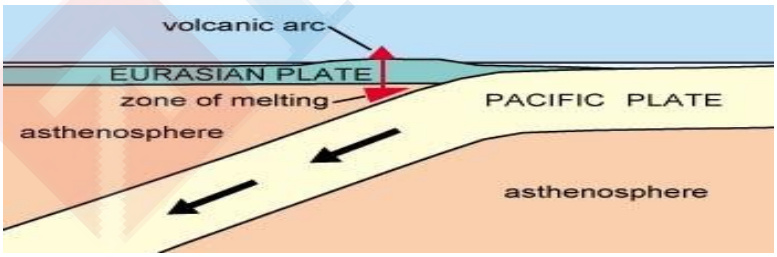
Q.47)
Ans) d
Exp) Option d is correct.



Statement a is correct. The circum-Pacific belt stretches along the Pacific Ocean coastlines, where the Pacific Plate interacts mostly with smaller tectonic plates like the Philippines plate, Nazca plate, Cocos plate. **The Pacific plate forms a convergent plate boundary with the Philippines plate.**

Statement b is correct. The Pacific plate forms divergent plate boundaries with Nazca plate and Cocos plate.

Statement c is correct. The Pacific plate also interacts with the Eurasian plate in this region.



Knowledge Base: When two continental plates collide (at a convergent plate boundary like the Ring of Fire), some crust is destroyed in the process. When a thin, dense oceanic plate collides with a relatively light, thick continental plate, the oceanic plate is forced under the continental plate- a phenomenon called subduction. When two oceanic plates collide, one is pushed under the other and magma from the mantle rises, forming undersea volcanoes in the nearby regions.

Q.48)

Ans) d

Exp) Option d) is correct.

Statement 1 is Incorrect:Direct sources only provide a part of the information. The interior of the earth can be understood onlyby indirect evidences as neither any one has noranyone can reach the interior of the earth. Direct and Indirect sources jointly provide us a large picture about the interior of the Earth.

Statement 2 is Incorrect:Meteors that reach the earth are the indirect source of information about Earth's interior. Although they do not come from the interior of Earth, the material and thestructure observed in the meteors are similar to that of the earth.

Increase in pressure and temperature with depth, gravitation, magnetic field, and seismic activity are the other sources ofobtaining indirect information.

Gold mines, Deep Ocean Drilling Project, Volcanic eruptions are Direct sources of information about interior of the Earth.

Q.49)

Ans) a

Exp) Option a is correct.

Pair 1 is incorrectly matched. Marble is a metamorphic rock that forms when limestone is subjected to the heat and pressure of metamorphism. It is composed primarily of the mineral calcite (CaCO3).

Pair 2 is incorrectly matched. Granite is a type of igneous rock. It forms from the slow crystallization of magma below Earth's surface. It is composed mainly of quartz and feldspar.

Pair 3 is incorrectly matched. Limestone is a sedimentary rock composed primarily of calcite, a calcium carbonate mineral with a chemical composition of CaCO3.

Pair 4 is correctly matched. Basalt is a dark-colored, fine-grained, igneous rock. It most commonly forms as an extrusive rock, such as a lava flow, but can also form in small intrusive bodies, such as an igneous dyke or a thin sill.

Knowledge Base: Igneous rocks are formed by the cooling of magma (molten rock) inside the Earth or on the surface. Sedimentary rocks are formed from the products of weathering of existing rocks. Metamorphic rocks are formed due to temperature and pressure changes inside the Earth.

Q.50)

Ans) a

Exp) Option a is correct.

Statement 1 is incorrect. The concept of sea floor spreading was antithetical to the assumptions made under the continental drift theory- the existence of a super continent, Pangaea and a mega-ocean, Panthalassa. The mapping of ocean floor revealed that constant eruptions at the crest of oceanic ridges cause the rupture of the oceanic crust and the upcoming lava pushes the oceanic crust on either side- thus the sea floor spreads.

Statement 2 is incorrect. The sea floor spreading occurs at divergent plate boundary. As the plates diverge, the ocean floor gets pushed due to volcanic eruptions at the crest and sinks down at the oceanic trenches.

Statement 3 is correct. The volcanic eruptions at the divergent plate boundary create mid –ocean ridge. The prominent mid-ocean ridges are- mid-Atlantic ridge and East Pacific rise.

Knowledge Base:

The detailed analysis of magnetic properties of the rocks on either side of the mid-oceanic ridge led Harry Hess (1961) to propose his hypothesis, known as the "sea floor spreading". Hess argued that constant eruptions at the crest of oceanic ridges cause the rupture of the oceanic crust and the new lava pushes the oceanic crust on either side- thereby spreading the ocean floor.

Q.51)
Ans) d
Exp) Option d is the correct answer.
Option a is incorrect: It is not the best answer because the passage does not explicitly state that food-yielding trees should replace other trees in rural and tribal areas or community-owned lands. The focus is on the productivity of trees and non-agricultural lands in providing a safety net and complementing agricultural food production.
Option b is incorrect: It is not the best answer because the passage does not explicitly claim that food security cannot be ensured with conventional agriculture. Instead, it emphasizes the benefits of sourcing food from non-agricultural lands to address food shortages caused by crop failure or seasonal gaps.
Option c is incorrect: It is not the best answer because the passage does not specifically mention wastelands or degraded areas in India as the primary focus. It acknowledges the potential of non-agricultural lands, such as forests, wetlands, and pastures, to contribute to food consumption, particularly in rural and tribal communities.
Option d is correct: It is the best answer because it suggests the development of agroecosystems in addition to or along with conventional agriculture. This aligns with the idea of sourcing food from non-agricultural lands, such as forests and wetlands, to provide a systemic approach to food consumption and enhance food security, especially during periods of crop failure or seasonal gaps.

Q.52)
Ans) a
Exp) Option a is the correct answer
Option a is correct: This statement directly addresses the issue highlighted in the passage, which is the lack of waste treatment by antibiotics-manufacturing companies. By implementing proper effluent treatment protocols, these companies can mitigate the pollution caused by their waste and reduce the spread of drug-resistant bacteria in the environment.
Option b is incorrect: It is not the best answer because the passage does not focus on the need to raise general environmental awareness. It specifically highlights the lack of waste treatment by pharmaceutical companies, which requires targeted solutions rather than just promoting awareness.
Option c is incorrect: It is not the best answer either. Although the passage mentions the occurrence of drug-resistant bacteria surrounding pharmaceutical manufacturing plants, it does not make a broad claim about drug-resistant bacteria being inherent in modern medical care. The focus is on addressing the specific pollution caused by the manufacturing process.
Option d is incorrect: It is not supported by the passage. The passage does not suggest relocating pharmaceutical manufacturing plants to remote areas as a solution to the pollution problem. It primarily highlights the need for waste treatment protocols, regardless of the location of these companies.

Q.53)
Ans) a
Exp) Option a is the correct answer
Option a is correct The passage emphasizes the importance of a strong learning foundation at the primary level in order to improve higher education and skill development. It states that the benefits of good quality school education are realized when students complete their education and acquire foundational skills. These foundational skills are compared to learning to walk before running, implying that they are necessary for acquiring advanced skills. The passage also mentions the advent of the knowledge economy and the consequences of having an uneducated workforce. It suggests that without a strong learning foundation at the primary level, a country may be unable to keep pace with the global

economy. This implies that investing in universal quality education is crucial for a country like India to become a global power.

Option b is incorrect because the passage does not directly state that India is unable to become a global power. It discusses the consequences of having an uneducated workforce, but it does not make a definitive statement about India's current status.

Option c is incorrect because the passage does not suggest that higher education should focus more on imparting skills. It emphasizes the importance of foundational skills acquired at the primary level for overall improvement in higher education and skill development.

Option d is incorrect because the passage does not mention the literacy or awareness level of parents. It focuses on the benefits of quality education and the impact of a strong learning foundation on the global economy.

Q.54)

Ans) d

Exp) Option d is the correct answer

Let's analyze the given information and statements to determine the correct answer:

From the given information:

- 75 persons took tea.
- 60 persons took coffee.
- 15 persons took both tea and coffee.
- No one taking milk takes tea.
- Each person takes at least one drink.

Now let's evaluate the statements:

Statement-1: 50 persons took milk.

This statement alone does not provide any information about the number of persons who attended the party or their drink preferences. It does not help us determine the total number of persons who attended the party. **Therefore, Statement-1 is not sufficient to answer the question**.

Statement-2: The number of persons who attended the party is five times the number of persons who took milk only.

This statement suggests a relationship between the number of persons who attended the party and the number of persons who took milk only. However, without knowing the number of persons who took milk only, we cannot determine the total number of persons who attended the party. **Therefore, Statement-2 is not sufficient to answer the question.**

Combining the statements:

By combining the statements, we know that 50 persons took milk, but we still don't have any information about the number of persons who took milk only. Without this information, we cannot determine the total number of persons who attended the party. **Therefore, even by using both statements together, the question cannot be answered.**

Based on the analysis above, the correct answer is (d) The Question cannot be answered even by using both the Statements together.

Q.55)

Ans) d

Exp) Option d is the correct answer

Given that we have a 3-digit number, let's assume the number can be represented as XYZ, where X, Y, and Z represent the digits.

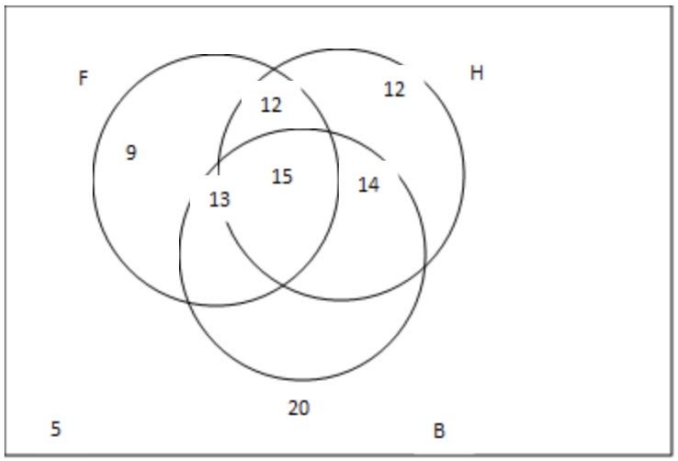
Statement-1: The sum of the digits of the number is equal to the product of the digits.

This means:

X + Y + Z = X * Y * Z
However, this statement alone does not provide enough information to determine the specific value of XYZ. There are multiple combinations of X, Y, and Z that satisfy this equation, such as 1 + 2 + 3 = 1 * 2 * 3 or 2 + 1 + 3 = 2 * 1 * 3. **Therefore, Statement-1 alone is not sufficient to answer the question.**
Statement-2: The number is divisible by the sum of the digits of the number.
This means: XYZ is divisible by (X + Y + Z)
Using this statement alone, we cannot determine the specific value of XYZ.
For example, if XYZ is 111 then the sum of the digits is 1 + 1 + 1 = 6, and XYZ is divisible by 3. However, if XYZ is 222, then the sum of the digits is 2 + 2 + 2 = 6, and XYZ is also divisible by 6. **Therefore, Statement-2 alone is not sufficient to answer the question.**
Since neither statement alone is sufficient to answer the question, let's consider both statements together:
Combining these two statements, if we consider XYZ as 312 it is divisible by 6, similarly, if we consider XYZ to be 132, it is divisible by 6. **Therefore, without any specific values or constraints provided in the statements, we cannot uniquely determine the value of XYZ.**
Therefore, the correct answer is option d

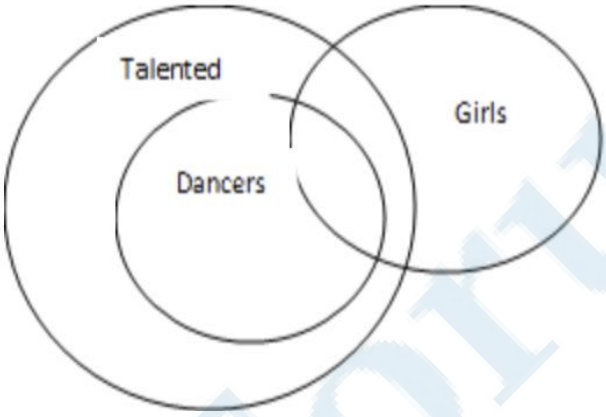
Q.56)
Ans) b
Exp) Option b is the correct answer
Let x is one number
Another number = 27 − x
Product of two numbers = 182
$x(27 - x) = 182$
$\Rightarrow x^2 - 27x - 182 = 0$
$\Rightarrow x^2 - 13x - 14x + 182 = 0$
$\Rightarrow x(x - 13) - 14(x - 13) = 0$
$\Rightarrow (x - 13)(x - 14) = 0$
$\Rightarrow x = 13$ or $x = 14$

Q.57)
Ans) a
Exp) option a is the correct answer
n(F) = percentage of students who like watching football = 49%
n(H) = percentage of students who like watching hockey = 53%
n(B)= percentage of students who like watching basketball = 62%
$n(F \cap H) = 27\%$; $n(B \cap H) = 29\%$; $n(F \cap B) = 28\%$
Since 5% like watching none of the given games so, $n(F \cup H \cup B) = 95\%$.
Now applying the basic formula,
$95\% = 49\% + 53\% + 62\% - 27\% - 29\% - 28\% + n(F \cap H \cap B)$
Solving, you get $n(F \cap H \cap B) = 15\%$.
Now, make the Venn diagram as per the information given



Number of students who like watching all the three games = 15 % of 500 = 75.

Q.58)
Ans) d
Exp) Option d is the correct answer
We can draw the following diagram from the given information:



1) Some girls are talented - True (as some girls are dancers and all dancers are talented, implies some girls who are dancers are talented too)
2) All talented are girls -> False (it is possible but not definite as shown in the diagram above)
3) All girls are talented -> False (it is possible but not definite as shown in the diagram above)
Hence, only conclusion I follow.

Q.59)
Ans) a
Exp) Option a is the correct answer
Step 1= Difference between E and I is 5 so only possibility is I = 9.
Step 2=Difference between F and I is 1, so only possibility is F = 8
Step 3=Difference between C and I is 3, so only possibility is C = 6.
Step 4= Sum of G and H is 6, so only Possibility is 1 + 5 or 5 + 1
Step 5= The remaining numbers are 2, 3 and 7 and it is given B is greater than D but smaller than A, **hence B = 3; D = 2 and A = 7**

Letter	Substituted by
A	7 (Step5)
B	3 (Step5)
C	6 (Step3)
D	2(Step5)
E	4 (given)
F	8 (step2)
G	1 or 5 (Step4)
H	5 or 1 (Step4)
I	9 (step 1)

Q.60)

Ans) c

Exp) Option c is the correct answer.

When interest is compounded half-yearly, the effective annual rate of interest is higher than the stated annual rate of interest. This is because the interest is earned on interest, which results in a higher overall return.

When interest is compounded annually, the effective annual rate of interest is equal to the stated annual rate of interest. This is because the interest is only earned on the principal amount, and not on the interest that has been earned.

Therefore, when the principal P becomes Q in 1 year when compounded half-yearly with R% annual rate of interest, the effective annual rate of interest is greater than R%. When the same principal P becomes Q in 1 year when compounded annually with s % annual rate of interest, the effective annual rate of interest is equal to s%.

Since the effective annual rate of interest is higher when interest is compounded half-yearly, R must be less than S.