1. Co-efficient of friction is the ratio of:

   1. force of friction to total weight of the two bodies
   2. force of friction to normal reaction between two bodies
   3. force of friction to reaction between two bodies
   4. force of limiting friction to normal reaction between two bodies

   Ans: 3

Note: Coefficient of friction (CoF) is a dimensionless number that is defined as the ratio between friction force and normal force acting on the surfaces

2. One metric horse power is equal to

   1. 746 watts 2. 736 watts 3. 550 watts 4. 75 watts

   Ans: 2

3. One British horse power is equal to

   1. 746 watts 2. 736 watts 3. 550 watts 4. 75 watts

   Ans: 1

4. The mechanical efficiency of an I.C. engine is equal to

   1. $\frac{\text{I.H.P.}}{\text{B.H.P.}}$ 2. $\frac{\text{F.H.P.}}{\text{B.H.P.}}$ 3. $\frac{\text{B.H.P.}}{\text{F.H.P.}}$ 4. $\frac{\text{B.H.P.}}{\text{I.H.P.}}$

   Ans: 4

5. Fuel injector is used in a

   1. Spark ignition engine 2. Steam engine
   3. Compression ignition engine (DSL engine) 4. Gas engine

   Ans: 3.(carburator is used in petrol or SI engine)

6. When two dissimilar metals are heated at one end and cooled at the other end, an emf is developed which is proportional to

   1. ratio of temperatures at the two ends
   2. difference of temperatures at two ends
   3. product of temperatures at two ends
   4. length of the metals

   Ans.2

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Note: The **thermoelectric effect** is the direct conversion of temperature differences to electric voltage and vice versa via a thermocouple. A thermoelectric device creates a voltage when there is a difference in temperature between the ends. Conversely, when a voltage is applied to it, heat is transferred from one side to the other, creating a temperature difference.

The term "thermoelectric effect" encompasses three separately identified effects: the **Seebeck effect**, **Peltier effect**, and **Thomson effect**. The Seebeck and Peltier effects are different manifestations of the same physical process.

The Thomson effect is an extension of the Peltier–Seebeck model and is credited to Lord Kelvin.

Joule heating, the heat that is generated whenever a current is passed through a conductive material, is not generally termed a thermoelectric effect. The Peltier–Seebeck and Thomson effects are thermodynamically reversible, whereas Joule heating is not.

7. Useful isotope of uranium for a nuclear reactor is

1. U^{238} 2. U^{235} 3. U^{236} 4. U^{233}

Ans: 2

Note: The primary natural ***isotopes of uranium*** are ***uranium***-235 (0.7 percent), which is fissile, and ***uranium***-238 (99.3 percent), which is fissionable but not fissile.
Uranium-235 is important for both nuclear reactors and nuclear weapons because it is the only isotope existing in nature to any appreciable extent that is fissile in response to thermal neutrons.
Natural uranium as found in the Earth's crust is a mixture largely of two isotopes: uranium-238 (U-238), accounting for 99.3% and uranium-235 (U-235) about 0.7%.

The isotope U-235 is important because under certain conditions it can readily be split, yielding a lot of energy. It is therefore said to be 'fissile' and we use the expression 'nuclear fission'.

ENERGY FROM THE URANIUM ATOM

The nucleus of the U-235 atom comprises 92 protons and 143 neutrons (92 + 143 = 235). When the nucleus of a U-235 atom captures a moving neutron it splits in two (fissions) and releases some energy in the form of heat, also two or three additional neutrons are thrown off.

https://www.world-nuclear.org/information-library/nuclear-fuel-cycle/introduction/what-is-uranium-how-does-it-work.aspx

8. The ratio of shear stress to shear strain is called

1. Poisson's ratio 2. Bulk modulus

3. Modulus of rigidity 4. Modulus of elasticity

Ans:3

9. The cross-sectional area of a rod is 10 cm^2. A pull of 10 tonnes is maximum stress produced in the rod would be

1. 1 tonne/cm^2 2. 0.5 tonne/cm^2 3. 4 tonne/cm^2 4.2 tonne/cm^2

Ans:1

10. The energy of a body by virtue of its position above earth is

1. Potential energy
2. Kinetic energy
3. Dynamic energy
4. Static energy

Ans: 1

11. Identify the type of motor recommended for locomotive drive

1. D.C. series motor
2. D.C. compound motor
3. D.C. shunt motor
4. Synchronous motor

Ans: 1

Note: Three types of motor are used in locomotives: DC motors, AC motors with variable frequency drives and AC permanent magnet motors.

Traditionally, these were series-wound brushed DC motors. The availability of high-powered semiconductors (thyristors and the IGBT) has now made practical the use of much simpler, higher-reliability AC induction motors known as asynchronous traction motors. Synchronous AC motors are also occasionally used, as in the French TGV.

12. Which place is known as the 'Cherapunji of South'?

1. Madikeri
2. Agumbe
3. Shimoga
4. Mangalore

Ans:2

Note: Karnataka receives the highest rainfall in **Southern** India. It is known as the "**Cherrapunji** of the **South".**

13. The energy of a body by virtue of its motion is

1. Potential energy
2. Kinetic energy

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4. Dynamic energy 4. Static energy

Ans:2

14. One metre is equal to

(1) 1.094 yards (2) 1125 yards (3) 1.212 yards (4) 1.0215 yards

Ans : 1

Note:1 m is equivalent to 1.0936 **yards**, or 39.370 inches.

15. The Supersonic jets tend to cause

(1) destruction of ozone layer (2) Noise pollution

(3) nervous system breakdown of people residing nearby the landing and take-off stations

(4) all the above

Ans : 4

A supersonic aircraft is an aircraft able to fly faster than the speed of sound (Mach number 1)

Sonic boom- Sonic boom is the sound associated with the shock waves created whenever an object travelling through the air travels faster than the speed of sound. Sonic booms generate significant amounts of sound energy, sounding similar to an explosion or a thunderclap to the human ear.

Sonic booms due to large supersonic aircraft can be particularly loud and startling, tend to awaken people, and may cause minor damage to some structures. They led to prohibition of routine supersonic flight over land. Although they cannot be completely prevented, research suggests that with careful shaping of the vehicle the nuisance due to them may be reduced to the point that overland supersonic flight may become a practical option. Sonic booms aren't just loud; they can also cause physical damage, breaking glass, cracking plaster, and shaking objects off shelves.

https://en.wikipedia.org/wiki/Supersonic_aircraft#:~:text=A%20sonic%20boom%20is%20the,than%20the%20speed%20of%20sound.&text=Sonic%20booms%20due%20to%20large,minor%20damage%20to%20some%20structures.

https://daily.jstor.org/the-problems-with-supersonic-flight/

16. Water boils at 100°C in Bombay. In Simla, it will boil at

1. more than 100°C 2. less than 100°C 3. 100°C 4. none of them

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Ans: 2

As we go higher in altitude, the atmospheric pressure decreases. This results in decreasing the **boiling** point at higher altitude and increase in **boiling** time of **water**. At sea level, water boils at 100 °C (212 °F). For every 152.4-metre (500 ft) increase in elevation, water's boiling point is lowered by approximately 0.5 °C. At 2,438.4 metres (8,000 ft) in elevation, water boils at just 92 °C (198 °F). Boiling as a cooking method must be adjusted or alternatives applied. A pressure cooker is often used to compensate for the low atmospheric pressure at very high elevations. Under these circumstances, water boils at temperatures significantly below 100°C and, without the use of a pressure cooker, may leave boiled foods undercooked.
https://en.wikipedia.org/wiki/High-altitude_cooking

High altitude areas are also prone to low humidity, which can cause the moisture in foods to evaporate more quickly during cooking. Covering foods during cooking will help retain moisture
https://www.fsis.usda.gov/shared/PDF/High_Altitude_Cooking_and_Food_Safety.pdf

17. Municipal water in India is generally treated with

1. Sodium Chloride
2. Potassium Permanganate
3. Sodium Carbonate
4. Chlorin

Ans : 4

18. Which of the following quantity is a scalar quantity?

1. Momentum
2. Torque
3. Energy
4. Impulse

Ans: 3

Note: A scalar quantity is defined as the physical quantity that has only magnitude, for example, mass and electric charge. On the other hand, a vector quantity is defined as the physical quantity that has both magnitude as well as direction like force and weight.

Scalar quantities are quantities that are described only by a magnitude. They do not have a direction of action, e.g., area, volume, • temperature T •density ρ,Speed, distance, etc.

Vector Quantities. Vector quantities have both magnitude and a direction of action.
e.g., • position or displacement, •velocity, •acceleration

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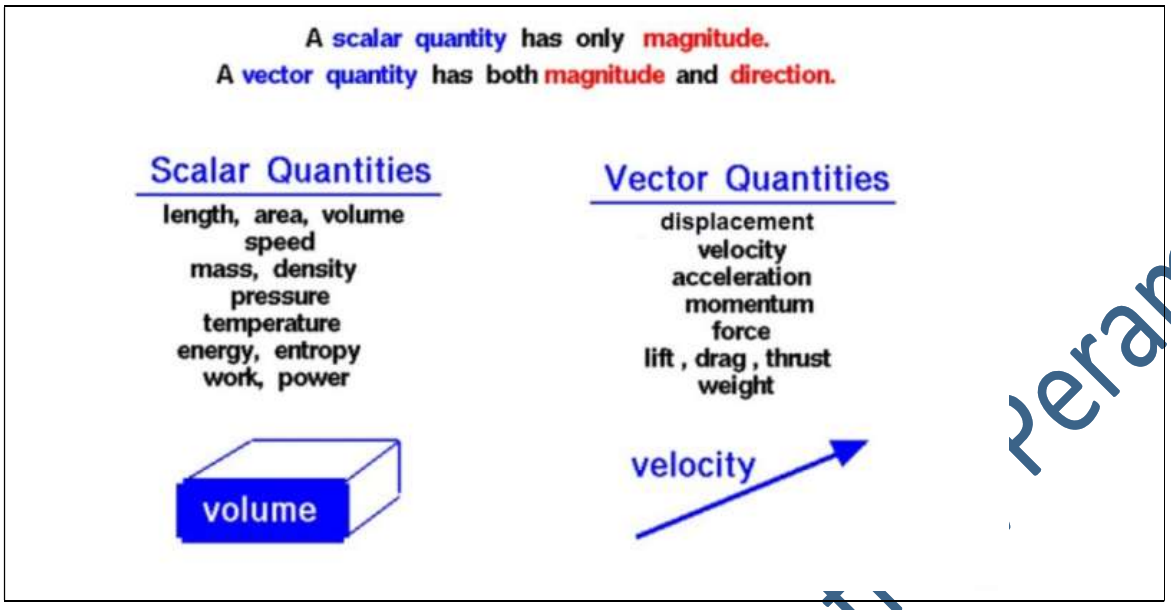

Source: https://www.grc.nasa.gov/www/k-12/airplane/vectors.html

19. The function of a gear box in an automobile is

1. To provide variable speed
2. to increase speed
3. to reduce speed
4. to produce torque

Ans: 1

Note: The purpose of a gearbox is to increase or reduce speed. As a result, torque output will be the inverse of the speed function. If the enclosed drive is a speed reducer (speed output is less than speed input), the torque output will increase; if the drive increases speed, the torque output will decrease.

20. A diode is a device which allows current

1. To flow in both direction
2. not to flow in any direction
3. To flow in one direction
4. none of these

Ans: 3

Note: A **diode** is a semiconductor device that essentially acts as a one-way switch for current. It allows current to flow easily in one direction.

Diode operation: (a) Current flow is permitted; the diode is forward biased. (b) Current flow is prohibited; the diode is reversed biased.

When the polarity of the battery is such that current is allowed to flow through the diode, the diode is said to be ***forward-biased***. Conversely, when the battery is "backward" and the

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diode blocks current, the diode is said to be ***reverse-biased***. A diode may be thought of as like a switch: "closed" when forward-biased and "open" when reverse-biased.

The direction of the diode symbol's "arrowhead" points at the direction of the current in conventional flow. This convention holds true for all semiconductors possessing "arrowheads" in their schematics. The opposite is true when electron flow is used, where the current direction is against the "arrowhead".

HYDRAULIC CHECK VALVE ANALOGY

Diode behavior is analogous to the behavior of a hydraulic device called a ***check valve***. A check valve allows fluid flow through it in only one direction as in the figure below.

Review

1. A *diode* is an electrical component acting as a one-way valve for current.
2. When voltage is applied across a diode in such a way that the diode allows current, the diode is said to be *forward-biased*.
3. When voltage is applied across a diode in such a way that the diode prohibits current, the diode is said to be *reverse-biased*.
4. The voltage dropped across a conducting, forward-biased diode is called the *forward voltage*. Forward voltage for a diode varies only slightly for changes in forward current and temperature, and is fixed by the chemical composition of the P-N junction.
5. Silicon diodes have a forward voltage of approximately 0.7 volts.
6. Germanium diodes have a forward voltage of approximately 0.3 volts.
7. The maximum reverse-bias voltage that a diode can withstand without "breaking down" is called the *Peak Inverse Voltage*, or *PIV* rating.

https://www.allaboutcircuits.com/textbook/semiconductors/chpt-3/introduction-to-diodes-and-rectifiers/

21. Core of a transformer is laminated to reduce

1. Eddy current loss
2. Heat loss
3. Hysteresis loss
4. All of these

Ans: 1

Note: The core is not ***designed to*** have any currents flow through it. It is however a conducting loop that experiences a changing magnetic field, it will therefore have small currents **induced** in it - these are called **'eddy currents**'.

The core is laminated to reduce these to a minimum as they interfere with the efficient transfer of energy from the primary coil to the secondary one. The eddy currents cause energy to be lost from the transformer as they heat up the core - meaning that electrical energy is being wasted as unwanted heat energy.

Laminated means 'made up of insulated layers of iron 'glued' together' rather than being in a single solid 'lump'. Laminated cores are used (rather than solid cores) to prevent these eddy currents flowing through circulating currents which have been set by magnetic fields that can break down cores into sheets each coated with insulating material that does not conduct electricity and allows eddy currents to flow.

WHY IS THE TRANSFORMER CORE LAMINATED?

The transformer core needs to be laminated to reduce the eddy current that has arisen from the induced voltages through the core, thereby reducing the heat loss of the entire core. Therefore the transformer core is laminated to minimize the eddy currents flowing through it.

Transformer steel

Transformer steel, is specialty steel tailored to produce certain magnetic properties, such as a small hysteresis area (small energy dissipation per cycle, or low core loss) and high permeability.

The Transformer steel can be also called lamination steel, silicon electrical steel, silicon steel or electrical steel.

The material is usually manufactured in the form of cold-rolled strips less than 0,23 to 0,35 mm thick for Grain Oriented ant up to 0,5 mm fon Non Oriented grain steel. These strips are called laminations when stacked together to form a core. Once assembled, they form the laminated cores of transformers or the stator and rotor parts of electric motors. Laminations may be cut to their finished shape by core cutting lines punch and die.

http://corefficientsrl.com/electrical-steel-for-transformer-cores/

22. The speed of an aircraft is measured by

(1) anemometer (2) Micrometer (3) speedometer (4) technometer

Ans. 1

23. Water pipes burst in severe winter at hill stations because

(1) they contract on cooling (2) water in the pipe contracts on freezing

(3) water in the pipe expandson freezing (4) pipes expand on cooling

Ans. 3

24. Which among the four is not closely allied to physiology?

(1) bio chemistry (2) cytology (3) entomology (4) physics

Ans. 4

25. Who amongst the following is regarded as 'Father of genetics'?

(1) Robert Hooke (2) Gregor Johann Mendel

(3) Charles Darwin (4) Hugo de Uries

Ans. 2

26. In the solar system, the brightest star next to Sun is

(1) pole star (2) Arcturos (3) Capella (4) Sirus

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Ans. 4

27. Which of the following is a balanced bio fertilizer for plants?

(1) urea (2) compost (3) nitrates (4) none of these

Ans. 1.

28. During sleep man's blood pressure

(1) increases (2) fluctuates (3) decreases (4) none of these

Ans. 2

29. 'Large Magellanic cloud' is the name given to

(1) Cyclonic clouds in China Bay (2) Milky-way

(3) Nearest galaxy to milky way (4) Black hole

Ans. 3

Note: The Large Magellanic Cloud (LMC) is a satellite dwarf galaxy of the Milky Way that is among the closest galaxies to Earth. At about 163,000 light-years from Earth, the dwarf galaxy looks like a faint cloud in Southern Hemisphere skies

30. Siderial period of Mars is

(1) 224.7 days (2) 686.98 days (3) 365.26 days (4) 87.97 days

Ans. 2

Note: Sidereal Period - True orbital period of a planet, the time it takes the planet to complete one full orbit of the Sun.

Planet	Synodic Period (days)	Sidereal Period
Mercury	116	88days
Venus	584	225 days
Earth	-	1.0 years
Mars	780	1,9 years
Jupiter	399	11.9 years
Saturn	378	29.5 years
Uranus	370	84.0 years
Neptune	368	164.8 years
Pluto	367	248.5 years

https://www.livephysics.com/physical-constants/astronomy-pc/synodic-sidereal-periods-planets/

31. The fastest planet in solar system is

1) Earth (2) Pluto (3)neptune (4) Mercury

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Ans. 4

Note: **Mercury** is the smallest and fastest planet in the solar system. It is also the closest planet to the sun. To overcome the pulling of gravitation of sun, Mercury has to be fastest to maintain its orbital motion. The force of attraction between sun and Mercury is given by Newton's law of universal gravitation.

32. Central Electro Chemical Research Institute (CECRI) a unit of CSIR is located at

(1) Chennai (2) Bangalore (3) Karaikudi (4) Pune

Ans: 3

33. Numismatics is the study of

(1) coins (2) numbers (3) stamps (4) space

Ans: 1

34. The function of hemoglobin is

(1) to transport oxygen (2) destruction of bacteria
(3) preventionof anemia (4) utilization of energy

Ans. 1

Note: Hemoglobin is essential for transferring oxygen in human blood from the **lungs** to the tissues. Myoglobin, in muscle cells, accepts, stores, transports and releases oxygen.

35. which of the following organisms does not contain chlorophyll?

(1) Ferns (2) Mosses (3) Fungi (4) Algae

Ans: 3

Note: Fungi do not have chlorophyll in their cells. Therefore they cannot produce food and must depend upon other living or dead things for food. They are heterotrophic and can be classified as saprophytes, parasites, symbionts.
In photosynthesis, the process by which light energy is converted to chemical energy through the synthesis of organic compounds. Chlorophyll is found in virtually all photosynthetic organisms, including green plants, cyanobacteria, and algae. It absorbs energy from light; this energy is then used to convert carbon dioxide to carbohydrates.

36 when a boat enters a river from the sea

(1) it floats higher (2) it sinks deeper
(3) it floats at the same depth (4) None of these

Ans: 2.

A ship sink more in river water than in sea water because the density of sea water is more than that of river water

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37. A narrow strip of land connecting two large areas of land is known as

(1) Isthmus (2) Strait (3) Archipelago (4) Peninsula

Ans:1

38. A plant cell is distinguished from an animal cell by the presence of

(1) Nucleus (2) Chloroplasts (3) Cell membrane (4) Cell wall

Ans: 4.

Box1.

Even though all living organisms are made of cells that contain similar structures, there are differences between the structures of the cells of plants and animals.

1. Structures that are common to plant and animal cells are the 1.cell membrane, 2.nucleus, 3. mitochondria, and 4.vacuoles.
2. Structures that are specific to plants are 1. the cell wall and 2. chloroplasts.

Major structural differences between a plant and an animal cell include:

1. Plant cells have a cell wall, but animals cells do not. Cell walls provide support and give shape to plants.
2. Plant cells have chloroplasts, but animal cells do not. Chloroplasts enable plants to perform photosynthesis to make food.
3. Plant cells usually have one or more large vacuole(s), while animal cells have smaller vacuoles, if any are present. Large vacuoles help provide shape and allow the plant to store water and food for future use. The storage function plays a lesser role in animal cells, therefore the vacuoles are smaller.

https://www.spart1.org/PlantAnimalCellDifferencesGeneticsNotes.aspx

Box 2

Note: Both animal and plant cells have mitochondria, but only plant cells have chloroplasts. Both plant and animal cells have vacuoles. A plant cell contains a large, singular vacuole that is used for storage and maintaining the shape of the cell. In contrast, animal cells have many, smaller vacuoles.

Plant cells have a cell wall, as well as a cell membrane. In plants, the cell wall surrounds the cell membrane. This gives the plant cell its unique rectangular shape. Animal cells simply have a cell membrane, but no cell wall

39. A boy is carrying a bucket of water (weighing 4 kg) in his let hand and a fish weighing 1 kg in his right hand. He drops the fish into the bucket and the fish immediately starts swimming. If the water in the bucket does not overflow, the total weight now carried by the boy will

(1) Remain the same (2) decrease (3) increase (4) first increase then decrease

Ans:1

40. A mercury barometer reads 76 cm, what would it read if a small hole is made at the top of the barometer?

(1) The reading will increase four times
(2) the reading will be doubled
(3)the reading will be zero
(4) the reading will be halved

Ans: 3

41. When a boat enters the sea from a river

(1) it floats higher
(2) it sinks deeper
(3) it floats at the same depth
(4) None of these

Ans: 1

The **sea** water is denser than **river** water. Hence a **ship** experiences more buoyant force in **sea** water than in **river** and hence the volume of **ship** immersed inside water decreases to balance the weight of the **ship**. Hence it rises when it passes from **river** to **sea**

42. India's anti-tank missile is

(1) Akash (2) Nag (3) Agni (4) Prithvi

Ans: 2

Note: The Nag missile, also called "Prospina" for the land-attack version, is an Indian third-generation, all-weather, fire-and-forget, lock-on after launch, anti-tank guided missile (ATGM) with an operational range of 500 m to 20 km.

The Arjun is a third generation main battle tank developed by India's Defence Research and Development Organisation (DRDO), for the Indian Army. The tank is named after Arjun, the archer prince who is the main protagonist of the Indian epic Mahabharata.

The T-90M Bhishma— named after a great legend named Bhishma, from the Indian epic Mahabharata— has been specially designed to operate in the cold and harsh conditions of Ladakh, Sikkim and Arunachal Pradesh regions of the country.

43. Gana Bird Sanctuary is located at

(1) Assam
(2) Gujarat
(3) Rajasthan
(4) Tamilnadu

ANS: 3.

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NOTE:

Keoladeo National Park or Keoladeo Ghana National Park formerly known as the Bharatpur Bird Sanctuary in Bharatpur, Rajasthan, India is a famous avifauna sanctuary that hosts thousands of birds, especially during the winter season.

44. Bokaro Steel Plant is situated in which State?

(1) Orissa
(2) Madhya Pradesh
(3) Jharkand
(4) Bihar

Ans:3

Note: Bokaro Steel Plant (BSP) is located in the Bokaro district of Jharkhand. It is the fourth integrated public sector steel plant in India built with Soviet helpMajor steel plants in India…

45. Which state leads in the production of tobacco ?

(1) Andhra Pradesh
(2) Madhya Pradesh
(3) Punjab
(4) Uttar Pradesh

Ans: 1

46. Specific gravity of milk is measured by

(1) Barometer
(2) Hydrometer
(3) Hygrometer
(4) Lactometer

Ans: 4.

Note: A **lactometer** is used to check purity of cow's milk. If the milk sample is pure, the **lactometer** floats; if it is adulterated or impure, the **lactometer** sinks. The **lactometer** test is used to determine if the milk has been adulterated with added water or solids. This test is based on the fact that milk has a heavier weight or density (1.026–1.032 g/ml) compared to water (1.000 g/ml)

47. Richter scale is used for measuring

(1) Density of liquid
(2) Intensity of earthquakes
(3)Velocity of wind
(4) Humidity of air

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Ans: 2

Note: A numerical scale for expressing the magnitude of an earthquake on the basis of seismograph oscillations. The more destructive earthquakes typically have magnitudes between about 5.5 and 8.9; it is a logarithmic scale and a difference of one represents an approximate thirtyfold difference in magnitude

The Richter magnitude scale, also known as the local magnitude (M) scale, assigns a number to quantify the amount of seismic energy released by an earthquake. It is a base-10 logarithmic scale.

48. Who among the following invented the small pox vaccine?

(1) Edward Jenner
(2) Robert Koch
(3) Robert Hook
(4) Louis Pasteur

Ans:1

49. A plant with green leaves placed in red light will appear

(1) Black
(2) Green
(3) Red
(4) Violet

Ans:1

Note: When you see an object all colours except the one of the object is absorbed so in **red light green leaf will** absorb **red** and you **will** practically see nothing

50. When water boils, its temperature

(1) begins to increases
(2) begins to decrease
(3) remains constant
(4) fluctuates

Ans: 3

Note: change of phase - freezing, boiling, melting and condensation takes place at constant temperature.

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