CHAPTER

GENERAL SCIENCE 4

MEASUREMENT

- Each base quantity is in terms of a certain basic, arbitrarily chosen but properly standardised reference standard called unit (such as metre, kilogram, second, ampere, kelvin, mole and candela). The units for the fundamental or base quantities are called fundamental or base units.
- **SI Base Units**

No.	Base quantity	SI units	Symbol
1	length	meter	m
2	mass	kilogram	kg
3	time	second	s
4	electric current	ampere	A
5	temperature	kelvin	K
6	amount of substance	mole	mol
7	luminous intensity	candela	cd

In addition there are two SI supplementary units the radian, the SI unit of the quantity plane angle; and the steradian, the SI unit of the quantity solid angle. Supplementary units are as follows:

SI Supplementary Units

No.	Supplementary quantity	Name	Symbol
8	plane angle	radian	rad
9	solid angle	steradian	sr

- **Angstrom:** An angstrom is a unit of length used to measure small things such as the wavelengths of light, atoms and molecules. Ten billion angstroms equal 1 meter $1\ Å = 10^{-10}$m.
  Fermi: A unit of length used to measure nuclear distances $= 10^{-15}$ meter.
- **Some SI Derived Units :**
  (i) Velocity $\rightarrow$ m/s
  (ii) Acceleration $\rightarrow$ m/s^2
  (iii) Force $\rightarrow$ kg m/s^2 (newton)
  (iv) Work $\rightarrow$ Nm (Joule)
  (v) Power $\rightarrow$ Joule/s (watt)
- By Newton's law of motion.
  Weight = Mass × Acceleration due to gravity
  In space the acceleration due to gravity (g) is zero and hence, the weight of the body is zero.
- The degree of hotness or coldness is called temperature.
- Thermometer is the device to measure temperature.
- Clinical thermometer is used to measure the temperature of a human body.
- The SI unit of density is kg/m^3. The density of gases and liquids varies with the change in temperature.
  Density of water = 1 gm/cm^3 = 1000 kg/m^3.
  Mercury = 13.6 gm/cm^3.
- The relative density (R.D.) of a substance is defined as the ratio of the density of the substance to the density of water.
- The variations in the density of gases and liquids with temperature result in convection currents in liquids and gases.
- A hydrometer is a device to measure density of liquids.

WORK AND ENERGY

- **Work :** In physics work is defined if force applied on object displaces the object in direction of force. We define the work as Product of the force and displacement in the direction of applied force or Product of displacement and force in the direction of displacement.
  W = Force × displacement
- **Unit of Work :** The SI unit of force is a newton and the unit of length is a metre (m). So the SI unit of work is newton-meter which is written as Nm. This unit (Nm) is also called joule (J), i.e. 1 joule = 1 newton . 1 metre
  Abbreviated, this is 1 J = 1 Nm
  When a force of 1 newton moves a body through a distance of 1 metre in its own direction the work done is 1 Joule.
- **Energy :** Anything which has the capacity to do work is said to possess energy. This implies that work can be done only at the expense (cost) of energy i.e., to do work, we need to spend energy, whatsoever be its form.
  Unit of Energy : Same as that of work i.e., Joules(J)
  Relation between kinetic energy and momentum:

$$p = \sqrt{2mk}$$

where p = momentum, k = kinetic energy, m = mass

(i) For same momentum :

K-energy varies inversely as the mass $K \propto \frac{1}{m}$

(ii) For same K-energy

Momentum varies directly as the square root of mass of the body. $p \propto \sqrt{m}$

- **Power :** The time rate of doing work is defined as power (P). If equal works are done in different times, power will be different. More quickly work is done, power will be more.

$$\text{Power} = \frac{\text{work}}{\text{time}}$$

- **Unit of Power :** The unit of power is the joule per second and this is called the watt (W). When large amounts of power are involved, a more convenient unit is the kilowatt (kW) where 1 kW = 1000 W.

  1 Megawatt = 10^6 watt

  Power was also measured earlier in a unit called horse power. Even these days, the unit of horse power is in common use.

  1 horse power = 746 watt

  The unit kilowatt-hour means one kilowatt of power supplied for one hour. It is, therefore, the unit of energy.

  1 KWh = (1000 J/s) × 60 × 60s = 3.6 × 10^6 J

MORE ABOUT SOLID, LIQUID AND GASES

- **Surface Tension :** A molecule of the liquid near the surface is attracted by fewer molecules of the liquid (there is only air on one side) then molecule deep inside. Therefore, the molecule of the free surface has less attractive force than the deeper one, and so it is energetically unfavaourable for a liquid to have a surface. This property of liquid surface is called surface tension.
- When the water touches the glass, it 'rises up' the glass surface then forms a concave meniscus.
- Mercury behaves in a different manner. Mercury molecules are attracted more strongly to other mercury molecules than they are attracted to glass molecules. Here, the cohesive force is stronger than adhesive force. That is why, when mercury touches the glass surface, it 'rises down' the glass forming a convex meniscus.
- **Pascal Law :** When pressure is applied to an enclosed fluid, it is transmitted equally to all parts of the fluid. This is called Pascal's law.
- Pascal's law holds, both for liquid and gases.
- **Buoyancy :** Every liquid exerts an upwards force on objects immersed in it. This upward force is called Buoyant force and this phenomenon is called Buoyancy.
- **Archimedes' Principle** states that the buoyant force is equal to the weight of this displaced liquid. The buoyant force exerted by a liquid, therefore, depends on the volume of the object immersed on it.
- When a body is wholly or partially immersed in a liquid, there is apparent loss in weight of the body, which is equal to the weight of the displaced liquid by the body.
- The rise or depression of liquids in small diameter tubes is called capillarity.
- The faster the air, the lower the pressure.
- **Different Temperature Scales :**

S.No.	Name of the scale	Symbol for each degree	Lower fixed point (LFP)	Upper fixed point (UFP)	Number of divisions on the scale
1	Celsius	°C	0°C	100°C	100
2	Fahrenheit	°F	32°F	212°F	180
3	Kelvin	K	273.15 K	373.15 K	100

- **Specific Heat Capacity :** The specific heat capacity of a substance is the amount of energy (in joule) that is needed to raise the temperature of 1 kg of the substance by 1°C.

  Sp. heat of water = 1 cal /gm °C = 4200 J/kg °C.

  Sp. heat of ice = 0.5 cal /gm °C.

  = 2100 J/kg °C.

- **Latent Heat :** The latent heat of a substance is that heat which changes the physical state of the substance but does not rise its temperature. Latent heat is of two types :

  1. Latent heat of melting 2. Latent heat of vaporisation
- The amount of thermal energy required to change the state of substance is given by the following formula :

  $Q = m \times L$

  where, m = mass of the substance

  L = Latent heat of the substance
- The coefficient of linear expansion (α_ℓ), superficial area expansion and volume expansion (α_v) are defined by the relations : $\frac{\Delta\ell}{\ell} = \alpha_\ell \Delta T$; $\frac{\Delta A}{A} = \beta \Delta T$; $\frac{\Delta V}{V} = \alpha_v \Delta T$

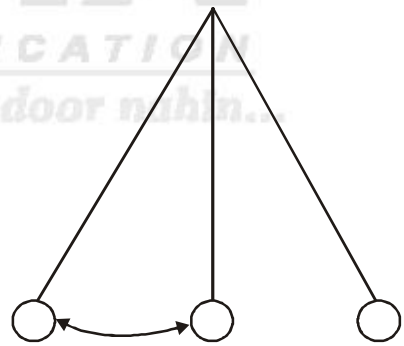
  where $\Delta\ell$ and ΔV denote the change in length ℓ and volume V for a change of temperature ΔT. The relation between them is : $\alpha_v = 3\alpha_\ell$; $\beta = 2\alpha_\ell$
- Newton's Law of Cooling says that the rate of cooling of a body is proportional to the excess temperature of the body over the surrounding.

SOUND

- **Sound :** Sound is a form of energy which produces a sensation of hearing in our ears.

  Frequency : The frequency of an oscillating particle is the total number of oscillations made by the pendulum/particle in one second.

  Amplitude : The maximum distance travelled by a pendulum towards any one side is from its initial position.



  Sound is emitted by vibrating source and is transmitted through a material medium producing sensation of hearing in our ears. The motion of a vibrating source sets up waves in the surrounding medium.
- **Types of Waves :** On the basis of the requirement of medium, waves are of two types

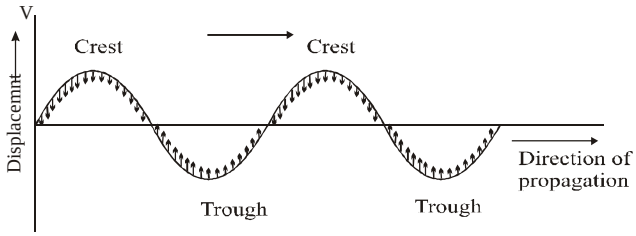
  (i) Mechanical waves (ii) Electromagnetic waves

  (i) Mechanical Waves : A mechanical wave is a periodic disturbance which requires a material medium for its propagation. The properties of these waves depend on the medium so they are known as elastic waves, such as sound-waves, water waves, waves in stretched string. On the basis of motion of particles the mechanical waves are classified into two parts.

  (a) Transverse wave (b) Longitudinal wave

  (a) Transverse wave : As shown in figure, when the particles of the medium vibrate in a direction perpendicular to the direction of propagation of the wave, the wave is known as

the transverse wave. For example, waves produced in a stretched string, waves on the surface. These waves travel in form of crests and troughs. These waves can travel in solids and liquids only.



(b) Longitudinal wave : As shown in figure, when the particles of the medium vibrate along the direction of propagation of the wave then the wave is known as the longitudinal wave. For example sound wave in air, waves in a solid rod produced by scrabbing.

These waves travel in the form of compressions and rarefactions. These waves can travel in solids, liquids and gases.

- Amplitude (A) is defined as the maximum displacement.
- The frequency ν of the wave is the reciprocal of its time period T, i.e., $\nu = \frac{1}{T}$

Wave velocity can be defined a the distance covered by a wave in one time period. Therefore,

$$\text{Wave velocity} = \frac{\text{Distance covered}}{\text{Time taken}} = \frac{\text{Wavelength}}{\text{Time taken}}$$

or $V = \lambda/T$ ..... (i)

As $\nu = \frac{1}{T}$, eq. (i) connecting V and λ in terms of the frequency ν can be written as

$V = \nu\lambda$ ..... (ii)

or Wave velocity = Frequency × Wavelength

Thus, the wave velocity is the product of frequency and wavelength. It holds true for any periodic wave, both for transverse or longitudinal waves.

ELECTROMAGNETIC WAVES

An accelerated charge produces a sinusoidal time varying magnetic field, which in turn produces a sinusoidal time varying electric field. The two fields so produced mutually perpendicular and are sources to each other. "The mutually perpendicular time varying electric and magnetic fields constitute electromagnetic waves which can propagate through empty space.

Characteristics of Electromagnetic waves

(i) The electric and magnetic fields satisfy the following waves equations

$$\frac{\partial^2 E}{\partial x^2} = \mu_0\varepsilon_0 \frac{\partial^2 E}{\partial t^2} \text{ and } \frac{\partial^2 B}{\partial x^2} = \mu_0\varepsilon_0 \frac{\partial^2 B}{\partial t^2}$$

where E and B are electric and magnetic field respectively.

(ii) Electromagnetic waves travel through vacuum with speed of light i.e. $c = 3 \times 10^8$ m/s.

(iii) The electric and magnetic fields of an electromagnetic wave are perpendicular to each other and also perpendicular to the direction of wave propagation. Hence, these are **transverse waves**.

(iv) The intantaneous magnitudes of $\vec{E}$ and $\vec{B}$ in an electromagnetic waves are related by the expression

$$\frac{\vec{E}}{\vec{B}} = C.$$

(v) Electromagnetic waves carry energy. The rate of flow of energy erossing a unit area is described by the poynting vector $\vec{S}$, where $\vec{S} = \frac{1}{\mu_0}\vec{E} \times \vec{B}$.

(vi) Electromagnetic waves obey the principle of superposition.

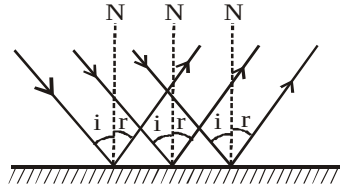
Radar : In this instrument radio waves of very short wavelength are used to locate the enemy aircraft or ship. A concave transmitter mounted on rotating platform sends radio waves in all directions. The radiowaves on striking the aircraft or ship are reflected back. The reflected radiowaves are received by concave receiver, which is mounted at a small angle with the transmitter. On receiving the radio waves, the position of enemy air-craft can be located on a monitor screen as a bright spot.

- **Applications of ultrasound :** The ultrasound is commonly used for medical diagnosis and therapy, and also as a surgical tool. It is also used in a wide variety of industrial applications and processes. Some creatures use ultrasound for information exchange and for the detection and location of objects. Also some bats are found to use ultrasound for navigation and to locate food in darkness or at a place where there is inadequate light for vision (method of search is called echolocation).

LIGHT

- Light is that form of energy which enables people to 'see' things. For a person to see any object, light energy must enter the eye. This energy is converted into a 'picture' in a very complex process, but a simplified version is as follows:
  - **(a)** light enters the eye through a 'hole' in the iris, called the pupil,
  - **(b)** the crystalline lens focusses the light to form a real, inverted image on the retina,
  - **(c)** energy is collected by the rods and cones making up the retina.
  - **(d)** this energy is transmitted as electrical impulses via the optic nerve to the brain,
  - **(e)** the brain re-inverts the image and produces a 'picture'.
- **Reflection :** When light rays strike the boundary of two media such as air and glass, a part of light is turned back into the same direction. This is called reflection of light.

Reflection → Specular reflection (on smooth surface)
→ Diffuse reflection (on rough surface)



REFRACTION

Whenever a wave is bounced back into same medium at an interface reflection is said to have occurred. Transmission of a wave into the second medium at an interface is called refraction.

- Twinkling of stars, appearance of sun before actual sunrise and after actual sunset etc. are due to atmospheric refraction.

➤ **Rainbow :** Rainbows are generated through refraction and reflection of light in small rain drops. The sun is always behind you when you face a rainbow, and that the center of the circular arc of the rainbow is in the direction opposite to that of the sun. The rain, of course, is in the direction of the rainbow i.e. rain drops must be ahead of you and the angle between your line-of-sight and the sunlight will be 40° – 42°.

➤ **Moon is seen red during total lunar eclipse**
Solar radiation will be refracted when passing through the earth's atmosphere. Therefore part of the sunlight can still reach the shadow of the earth. Besides, the earth atmosphere scatters most of the blue light , so there will be more red light reaching the moon. The red light will be reflected back to earth. That is the reason why you can see a red moon rather than total darkness.

ELECTRICITY

➤ The electrical devices we encounter most often in modern life such as computers, lights and telephones involve moving charges which we call electric currents.

➤ **Electric Current :** We define the electric current, or simply the current, to be the net amount of positive charge passing per unit time across any section through the conductor in the sense from the positive toward the negative terminal.

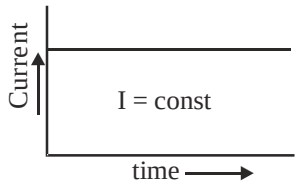
➤ The SI unit of current is the ampere (A), where 1A = 1 C/s that is, 1A of current is equivalent to 1C of charge passing through the surface in 1s. In practice, smaller units of current are often used, such as the milliampere ($1mA = 10^{-3}$ A) and the microampere ($1\mu A = 10^{-6}$ A)

➤ If the charge on an electron is e and n electrons pass through a point in time t then the total charge passing through that point will be Q = ne. Therefore the current

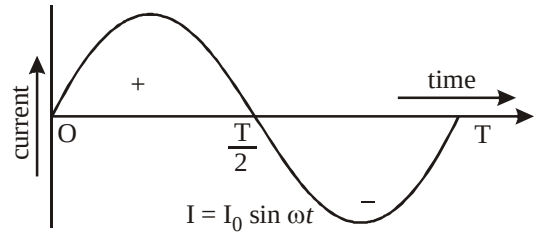
$$I = \frac{ne}{t} \text{ where, } e = 1.6 \times 10^{-19} \text{ coulomb.}$$

➤ **Types of Current**

(a) Direct current : The current whose magnitude and direction does not vary with time is called direct current (dc). The various sources are cells, battery, dc dynamo etc.



(b) **Alternating current:** The current whose magnitude continuously changes with time and periodically changes its direction is called alternating current. It has constant amplitude and has alternate positive and negative halves. It is produced by ac dynamo. In India AC supply is at 50 Hz.

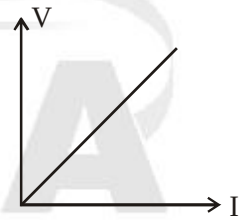


➤ **Resistance :** Opposition to electric current depends on the type of material, its cross-sectional area, and its temperature. It is technically known as resistance. (It can be said that conductors have low resistance and insulators have very high resistance.)

➤ **Ammeter :** Determines the value of current flowing in the circuit. The resistance of ammeter is small and it is used in series with the circuit.

➤ **Voltmeter :** Determines the potential difference between two points in the circuit. Its resistance is high and it is used in parallel with the resistance wire.

➤ **Ohm's law :** According to Ohm's law "The current passing through a conductor is directly proportional to the potential difference at its ends, provided the physical conditions of the conductor remain unchanged."



$V \propto I$ or $V = RI$

where R is a constant which is called resistance.

Unit of resistance $R = \frac{V}{I} = \frac{\text{volt}}{\text{ampere}} = \text{ohm } (\Omega)$

➤ **Fuse wire :** Fuse is a thin wire made an alloy of low melting point and low resistance. When the current exceeds the allowed limit in the circuit, the fuse wire melts due to the heating and the circuit gets disconnected, resulting into zero current in the circuit. Because of this the possibility of fire or accident is prevented.
Separate fuses are used for different circuits in the houses. Fuse wire is always connected to the phase wire. Once the fuse wire is damaged, it is replaced for normal flow of current.

CAPACITORS AND CAPACITANCE

A capacitor or **condenser** is a device that stores electrical energy. It generally consists of two conductors carrying equal but opposite charges.
The ability of a capacitor to hold a charge is measured by a quantity called the **capacitance.**

BINDING ENERGY

Binding energy of a nucleus is the energy with which nucleons are bound in the nucleus. It is measured by the work required to be done to separate the nucleons an infinite distance apart from the nucleus, so that they may not interact with one another.

NUCLEAR FORCE

It is the force acts in the nucleus between the nucleons and is responsible for binding the nucleon.

RADIOACTIVITY

It is the spontaneous disintegration of the heavy nucleus of an atom (It occurs without external provocation).

It is a process by which an unstable nuclei achieves stability.

NUCLEAR REACTION

Nuclear reaction obeys following conservation laws :

(1) Charge conservation

(2) Conservation of linear momentum

(3) Conservation of angular momentum

(4) Conservation of energy (Rest mass energy + K.E.)

Nuclear Reaction are of two types:-

(a) Nuclear Fission (By Otto Hans and Fstrassmann)

Nuclear fission is the disintegration of a heavy nucleus upon bombardment by a projectile, such that the heavy nucleus splits up into two or more segments of comparable masses with an enormous release of energy.

(b) Nuclear Fusion

Nuclear fusion is the fusion of two or more light nuclei to form a heavy nucleus with a release of huge amount of energy. The nuclear fusion reaction, which is the source of the energy of sun/ star are proton-proton cycle.

USES OF ELECTROMAGNETIC WAVES

The following are some of the uses of electromagnetic waves

1. **Radio waves** are used in radio and T.V. communication systems.
2. **Microwaves** are used in microwave oven.
3. **Infrared radiations** are used (a) in revealing the secret writings on the ancient walls (b) in green houses to keep the plants warm (c) in warfare, for looking through haze, fog or mist as these radiations can pass through them.
4. **Ultraviolet radiations** are used in the detection of invisible writing, forged documents, finger prints in forensic laboratory and to preserve the food stuffs.
5. The **study of infrared, visible and ultraviolet radiations** help us to know through spectra, the structure of the molecules and arrangement of electrons in the external shells.
6. **X-rays** can pass through flesh and blood but not through bones. This property of X-rays is used in medical diagnosis, after X-rays photographs are made.
   The study of X-rays has revealed the atomic structure and crystal structure.
7. The study of **γ-rays** provides us valueable information about the structure of the atomic nuclei.
8. **Super high frequency electromagnetic waves** (3000 to 30,000 MHz) are used in radar and satellite communication.
9. **Electromagnetic waves (frequency 50 to 60 Hz)** are ued for lighting. These are weak waves having wavelength 5×10^6 to 6×10^6 m and can be produced from A.C. circuits.

EMISSION OF ELECTRON

Electrons from the metal surface are emitted by anyone of the following physical processes :

(i) Thermionic emission : The emission of electrons by suitably heating the metal surface.

(ii) Field emission : The emission of electrons by applying very strong field of the order of 10^8 Vm^{-1} to a metal.

(iii) Photo-electric emission : The emission of electrons when light of suitable frequency illuminates metal surface.

PROPAGATION OF RADIO WAVES THROUGH THE ATMOSPHERE

It takes place in three ways :

(i) Ground wave propagation,

(ii) Sky wave propagation and

(iii) Space wave propagation.

(i) Ground wave propagation : When the radio wave travel directly from one point to another following the surface of the earth, it is called ground or surface wave. This type of transmission is possible only with waves of wavelengths above 200 m or frequencies below 1500 k Hz.

(ii) Sky wave propagation : When a radiowave is directed towards the sky and is reflected by the ionosphere towards desired location on the earth, it is called sky wave. This method is useful for the transmission of waves of wavelengths less than 200 m or frequencies above 1500 k Hz upto 30 MHz.

(iii) Space wave propagation : For the transmission of television signals (frequencies in the range 100-200 M Hz), space wave propagation method is used, in which the wave travels directly from a high transmitting antenna to the receiving antenna.

- Radio waves also known as electromagnetic waves which when radiated from transmitting antenna, travel through space to distant places where they are picked up by receiving antenna .

Different layers of atmosphere and their interaction with the propagating electromagnetic waves

Name of the stratum (layer) of atmosphere		Approximate height over earth's surface	Exists during	Frequencies most affected
Troposphere		10 km	Day and night	VHF (up to several GHz)
D (part of stratosphere)	Parts of ionosphere	65-75 km	Day only	Reflects LF, absorbs MF and HF to some degree
E (part of stratosphere)		100 km	Day only	Helps surface waves, reflects HF
F_1 (part of mesosphere)		170-190 km	Daytime, merges with F_2 at night	Partially absorbs HF waves yet allowing them to reach F_2
F_2 (thermosphere)		300 km at night, 250-400 km	Day and night	Efficiently reflects HF waves, particularly at

POLYMERS

- Have high molecular mass and formed by union of monomers.
- **Homopolymers :** Polymers made of same monomer.
- **Copolymers :** Polymers made of different types of monomers.

Classification of Polymers on the Basis of Source

(a) Natural polymers : Proteins, cellulose, starch, resins and rubber.

(b) **Semi-synthetic polymers :** Cellulose derivatives as cellulose acetate (rayon) and cellulose nitrate, etc.

(c) **Synthetic polymers :** Plastic (polythene), synthetic fibres (nylon 6, 6) and synthetic rubbers (Buna – S).

Classification Based on Mode of Polymerisation

(i) **Chain growth polymers or addition polymers :** They are formed by successive addition of monomers without loss of simple molecules like H_2O, NH_3 etc. e.g. polythene.

(ii) **Condensation polymers :** They are formed by the condensation reactions between two monomers, each monomers having two functional groups, with the elimination of small molecules such as water, alcohol and ammonia, *e.g.*, Nylon 66.

Classification Based on Molecular Forces

(i) **Elastomers :** The strands of polymer are held together by weak inter molecular forces (van der waal's). e.g.- **vulcanised rubber**.

(ii) **Fibres** are held together by hydrogen bonds. e.g.- **nylon, polyester, polyamide**.

(iii) **Thermoplastics** can be easily moulded on heating. They don't have cross-links, e.g.- **polyethene**.

(iv) **Thermosetting polymers** have cross links, cannot be remolded on heating. e.g.- **Bakelite**.

(v) **Plastisizer** are high boiling esters which are added to plastic to make it soft and rubber like.

Natural Rubber

- It is cis 1, 4-polyisoprene. It is a linear 1,4-polymer of isoprene. It is manufactured from rubber latex which is a colloidal suspension of rubber in water.
- The process of heating a mixture of raw rubber and sulphur at 373 K to 415 K is known as **vulcanisation of rubber**. The process of vulcanisation is accelerated by additing additives such as ZnO.

Synthetic Rubbers

- These are either homopolymers of 1, 3-butadiene derivatives or are copolymers in which one of the monomers is 1, 3-butadiene or its derivatives. Examples are Buna – S, Buna – N, neoprene and butyl rubber.

PLASTIC

1. **Thermoplastics** are those plastics, which can be melted and moulded into any desired shape without any change in the chemical composition and mechanical properties.
   - They are hard at room temperature, become soft and viscous on heating and again become rigid on cooling.
   - Examples are polyethylene (polyethene), polyester, polyvinyl chloride (PVC) and polypropylene (polypropene).
   - These plastics can be moulded into toys, beads, buckets, telephone and television cases.
2. **Thermosetting Plastics** can be heated only once and, when set into a solid (a shape or a pattern), it is permanent, as these cannot be remelted or recast. For example, bakelite and teflon.

PETROLEUM AND COMBUSTION

1. **Types :** Coal comes in four main varieties.
   - **Peat : T**his is a material in the first stage of coal formation. It contains about 60% carbon and is considered to be the lowest grade of coal.
   - **Lignite:** This variety of coal contains about 67% carbon. It has poor heating power. It is brown in colour but lustrous when dry.
   - **Wituminous:** It is a soft coal containing about 88% carbon. It gives a large proportion of gas when heated and burns with a yellow, luminous flame.
   - **Anthracite:** It is a hard coal and contains about 96% carbon. It is lustrous. It burns without smoke and gives much heat and little ash.

METAL & NON-METAL

1. All the materials found in the earth's crust are made up of chemical elements.
2. All these elements can be broadly divided into two classes: **Metals** and **Non-metals**
   Note : Out of 117 elements 83 are naturally occuring. Out of total 117 elements about 24 are non-metals and rest are metals.
3. **Physical Properties of Metals**
   - Metals, in their pure state, possess a shining surface (metallic lustre). Freshly cut metals have a bright metallic lustre.
   - Metals are solid at room temperature. Mercury is the only metal that is liquid at room temperature.
   - Metals are generally hard and strong. But metals like sodium and potassium are exceptionally very soft and can be cut with a knife.
   - Metals have high melting and boiling points. Sodium, potassium, gallium and mercury have low melting and boiling points.
   - Metals are good conductors of heat. Silver, followed by copper and aluminium, is the best conductor of heat. These days, cooking vessels and other utensils are made up of copper and aluminium.
   - Metals are also good conductors of electricity. Silver, followed by copper, gold and aluminium, is the best conductor of electricity. Copper and aluminium are used for making electrical wires.
   - Metals are sonorous. They make a ringing sound when struck.
   - Metals are usually malleable. They can be hammered into thin sheets and rolled into different shapes without breaking. Gold and silver are the most malleable metals.
   - Metals are generally ductile. They can be easily drawn into wires. Gold and silver are most ductile metals. Copper wires are used for electrical purposes.
   - Metals have high tensile strength, i.e. they can hold heavy loads without breaking.
   - Metals have high densities i.e. they are heavy in nature. Sodium and potassium metals are exceptions as they have low densities and float on water.
4. **Corrosion** is the process of slowly eating away of metal due to attack of atmospheric gases and water on the surface of metal. The most common example of corrosion is the **rusting of iron**.
   Rusting is the corrosion of iron on exposure to atmosphere

$$2Fe\,(s) + \frac{3}{2}O_2\,(g) + xH_2O\,(l) \longrightarrow Fe_2O_3.xH_2O\,(s)$$

i.e., rust is hydrated iron (III) oxide

5. **Non-metals** are quite abundant in nature. They are main constituent of atmosphere.
   - Oxygen, nitrogen and noble gases are present in the air.
   - Non-metals are also present in large amounts in oceans.
   - Hydrogen and oxygen are present as water and chlorine is present as chlorides in the oceans.
   - Oxygen, silicon, phosphorus and sulphur are present in the earth's crust.
6. **Physical Properties of Non-metals**
   - Non-metals are either solids or gases at room temperature. Bromine is the only liquid non-metal at room temperature.
   - Non-metals are soft. Phosphorus is so soft that can be cut with a knife. Diamond, an allotrope of carbon, is the hardest known substance.
   - Non-metals have low tensile strength, i.e. they are not strong and break easily.
   - Non-metals are non-lustrous and have a dull appearance. Graphite, an allotrope of carbon and iodine have shining lustrous surfaces.
   - Non-metals are non-malleable and non-ductile. They cannot be hammered into sheets or drawn into wires. These are brittle solids. When non-metals like sulphur, are hammered or stretched, they break into pieces.
   - Non-metals are non-conductors or bad conductors of heat and electricity. Gas carbon and graphite are good conductors of heat and electricity.
   - Non-metals are non-sonorous i.e. do not make a ringing sound when struck.
   - Non-metals usually have low densities.

IMPORTANT ORES

Oxide Ore	
ZnO	Zincite
MnO_2	Pyrolusite
SnO_2	Cassiterite
Cu_2O	Cuprite
Fe_2O_3	Haematite
$Al_2O_3.2H_2O$	Bauxite
$FeO.Cr_2O_3$	Chromite
Fe_3O_4	Magnetite
$Fe_2O_3.3H_2O$	Lymonite
$3BeO.Al_2O_3.6SiO_2$	Beryl
Sulphide Ore	
ZnS	Zinc blende
HgS	Cinnabar
PbS	Galena
Ag_2S	Argentite or Silver glance
FeS_2	Iron pyrites
$CuFeS_2.CuS.FeS$	Copper pyrites
$Cu_2S.Ag_2S$	Copper silver glance
$Ag_2S.Sb_2S_3$	Pyrargyrites, Ruby silver
FeAsS	Arsenickel Pyrites
Halide Ore	
NaCl	Rock Salt
AgCl	Horn Silver
CaF_2	Flour Spar
$AlF_3.3NaF$	Cryolite
$KCl\ MgCl_2.6H_2O$	Camelite
Carbonate Ore	
$MgCO_3$	Magnesite
$CaCO_3$	Lime stone
$MgCO_3.CaCO_3$	Dolomite
$ZnCO_3$	Calamine
$PbCO_3$	Cerusite
$FeCO_3$	Siderite
$CuCO_3.Cu(OH)_2$	Malachite
$2CuCO_3.Cu(OH)_2$	Azurite
$SrCO_3$	Strontianite
Sulphate Ore	
$BaSO_4$	Barytes
$PbSO_4$	Anglisite
$CaSO_4.2H_2O$	Gypsum
$MgSO_4.7H_2O$	Eypsomite
$SrSO_4$	Celestine
$K_2SO_4.Al_2(SO_4)_3.24H_2O$	Alum
$K_2SO_4.Al_2(SO_4)_3.4Al(OH)_3$	Alunite or Alumstone
Silicate Ore	
$LiAl(SiO_3)_2$	Spodumene
$KAl\ Si_3O_8$	Felspar
$Al_2O_3.2SiO_2.2H_2O$	Caolin (or China-Clay)
$3BeO.Al_2O_3.6SiO_2$	Beryl
$CaO.3MgO.4SiO_2$	Asbestos
$K_2O.3Al_2O_3.6SiO_2 2H_2O$	Mica
$KH_2.Al_3.(SiO_3)_4$	
Nitrate Ore	
$NaNO_3$	Chili-Salt Peter
KNO_3	Salt peter or Indian salt peter
Phosphate Ore	
$Ca_3(PO_4)_2$	Rock Phosphate
$Fe_3(PO_4)_2.8H_2O$	Vivianite
$AlPO_4.Al(OH)_3.H_2O$	Terguoise

FAMOUS PROCESSES AND RELATED METALS

Poling	Cu
Perkes Process	Ag
Pattinson process	Ag
Cupellation process	Ag
Baeyer's Process	Al
Serpek's process	Al
Hall's process	Al
Siemens Martin open halth furnace	Fe
L.D. Process	Fe
Tempering	Fe

POLLUTANT

A pollutant is substance or energy introduced into the environment that has undesired effects, or adversly affects the usefulness of a resource. The pollutants may be inorganic, biological or radiological in nature.

Pollutants

Primary Pollutants	Secondary Pollutants	Bio-degradable Pollutants	Non-Biodegradable Pollutants
(H_2S, SO_2, CO, NO, HF, NH_3 Smoke, Dust, Fumes)	(SO_3, NO_2, CH_4, Aldehydes, Ketones, Nitrates, Sulphates)	(Domestic Waste)	(Mercuric salt, Lead compounds, Pesticides.etc.)

AIR POLLUTION

Major Air Pollutants

The major air pollutants are following :

(i) Carbon monoxide (CO)
(ii) Sulphur dioxide (SO_2)
(iii) Oxides of nitrogen (NO_2 and NO)
(iv) Smoke, dust
(v) Ammonia
(vi) Chlorine and hydrogen chloride
(vii) Chlorinated hydrocarbons
(viii) Mercaptans
(ix) Zn and Cd
(x) Freon

Photochemical pollutants : The nitrogen dioxide by absorbing sunlight in blue and U. V. region decomposes into nitric oxide and atomic oxygen followed by a series of other reactions producing O_3, formaldehyde, acrolein and peroxyacylnitrates.

SMOG

It is a mixture of smoke and fog in suspended droplet form. It is of two types :

(a) **London smog or classical smog :** It is coal smoke plus fog.
(b) **Photochemical smog or Los Angeles smog :** The oxidised hydrocarbons and ozone in presence of humidity cause photochemical smog.

ACID RAIN

The oxides of C, N and S present in the atmosphere, dissolve in water and produce acids which lowers the pH of water below 5.5. The acids are toxic to vegetation, react with marble and damage buildings.

GREEN HOUSE EFFECT

The retention of heat by the earth and atmosphere from the sun and its prevention to escape into the outer space is known as green house effect. Global warming refers to an increase in average global temperature.

(i) Global warming would result in rise in sea level due to increased rate of melting of glaciers and floods.
(ii) Increase in infectious diseases like Malaria, Dengue etc.

OZONE LAYER AND ITS DEPLETION

The ozone layer, existing between 20 to 35 km above the earth's surface, shield the earth from the harmful U. V. radiations from the sun. The U. V. radiations cause skin cancer, cataract of eye, and are harmful to vegetation.

Depletion of ozone is caused by oxides of nitrogen

The presence of chlorofluorocarbons also increase the decomposition of O_3.

WATER POLLUTION

The contamination of water by foreign substances which would constitute a health hazard and make it harmful for all purposes (domestic, industrial or agriculture etc.) is known as water pollution.

Sources of Water Pollution

(i) Domestic sewage
(ii) Industrial waters
(iii) Suspended particles
(iv) Wastes from fertilizer

Control of Water Pollution

(i) Recycling of waste water
(ii) Special techniques
(iii) Waste-water reclamation

Aerobic and Anaerobic Oxidation

The oxidation of organic compounds present in sewage in presence of good amount of dissolved or free oxygen (approx. 8.5 ml/l) by aerobic bacterias is called *aerobic oxidation*. When dissolved or free oxygen is below a certain value the sewage is called *stale* anaerobic bacterias bring out purification producing H_2S, NH_3, CH_4, $(NH_4)_2S$ etc. This type of oxidation is called *anaerobic* oxidation. The optimum value of D.O. for good quality of water is 4-6 ppm (4-6 mg/l). The lower the concentration of D.O., the more polluted is the water.

Biological Oxygen Demand (BOD)

It is defined as the amount of free oxygen required for biological oxidation of the organic matter by aerobic conditions at 20°C for a period of five days. Its unit is mg/l or ppm. An average sewage has BOD of 100 to 150 mg/l.

Chemical Oxygen Demand (COD)

It is a measure of all types of oxidisable impurities (biologically oxidisable and biologically inert organic matter such as cellulose) present in the sewage. COD values are higher than BOD values.

SOIL OR LAND POLLUTION

The addition of substances in an indefenite proportion changing the productivity of the soil is known as soil or land pollution.

Sources of Soil Pollution

(i) Agricultural pollutants (ii) Domestic refuge
(iii) Radioactive wastes (iv) Farm wastes

PESTICIDES

The chemical substances used to kill or stop the growth of unwanted organisms are called pesticides.

CHEMOTHERAPY

Branch of chemistry dealing with treatment of diseases by suitable chemicals.

Analgesics

Drugs used for relieving pain.

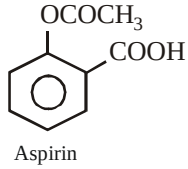
(a) Aspirin (2-acetoxy benzoic acid) is the most common analgesic. It has antipyretic (temperature lowering) properties also.

(b) These days, aspirin is used for the prevention of heart attack as it prevents clotting of blood.

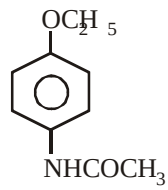
(c) In case of severe pain, narcotics like morphine, codeine and heroin can also be used.

Antipyretics

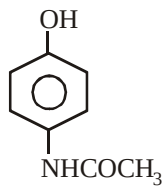
It brings down body temperature during high fever. e.g.-



Aspirin



Phenacetin



Paracetamol

Antimalarials

These are drugs which cure malaria e.g.- **quinine**, **chloroquine**.

Antiseptics and Disinfectants

Antiseptics	Disinfectants
• prevents growth of microorganisms or may even kill them.	• kills and prevents growth of microorganisms.
• **Not harmful for humans**	• **Harmful for humans**.
Examples :	*Example :*
(i) Dettol (chlorohexenol + terpeneol)	**(1% of solution of phenol)**
(ii) Bithional	
(iii) Salol	

Tranquilizers

Used to treat mental diseases and stress. They act on central nervous system and reduce anxiety. e.g.- **Barbituric acid**, **luminal**, **seconal**.

Antibiotics

Chemicals which are produced by some specific micro-organism and are used to kill other micro-organism. e.g.- **Penicillin**, **Streptomycin** (for tuberculosis), **Chloroamphenicol** (for typhoid). **Broad spectrum antibiotics** can kill all range of micro-organisms. e.g.- Tetracyclin.

Sulphadrugs

These are derivative of sulphanilamide and have antibacterial powers.

Antihistamines

Drugs used to treat allergy such as skin rashes. They are called so because allergic reactions are caused due to the liberation of histamine in the body.

(a) These drugs are also used for treating conjuctivitis (inflammation of conjuctiva) and rhinitis (inflammation of nasal mucosa).

(b) The commonly used antihistamines drugs are diphenyl hydraamine, chloropheniramine, promethazine and cetrizine.

Antacids

Antacids are the drugs which neutralize excess acid in the gastric Juices and give relief from acid indigestion. They remove the excess acid and raise the pH to appropriate level in stomach. These are mainly weak bases.

Examples– $Mg(OH)_2$, $KHCO_3$

Antifertility Drug

The drugs which are used to control the pregnancy are known as antifertility drugs or oral contraceptives. These are essentially a mixture of estrogen and progesterone derivatives.

Examples – Ormeloxifene, mix pristone

Artificial Sweeteners

The chemical compounds that are added to foods to make them sweet.

(a) Saccharin is the first artificial sweetener used as it is water soluble sodium or calcium salt.

(b) Nowadays aspartame is used as artificial sweetener, but it is unstable at cooking temperatures.

(c) Alitame, another sweetener is more stable than aspartame at cooking temperature.

Food Preservatives

The chemical substances that are added to the food to prevent their decaying and to retain their nutritive value for long periods.

- Sodium benzoate is the most commonly used preservative.

SOAPS AND DETERGENTS

Soaps

Sodium or potassium salts of long chain fatty acids, *e.g.*, stearic oleic and palmitic acids. Soaps containing sodium salts are formed by heating fat (*i.e.*, glyceryl ester of fatty acid) with aqueous sodium hydroxide solution. This process is called **saponification**.

- Soaps do not work in hard water. Hard water contains Ca^{+2} and Mg^{+2} ions. These ions form insoluble calcium and magnesium soaps respectively when sodium or potassium soaps are dissolved in hard water. These insoluble soaps separate as scum in water and are useless as cleansing agent.

Synthetic Detergents

Sodium salts of alkylbenzene sulphonic acids. They are better cleansing agents than soap. These are of three types:

(a) **Anion detergents** are those detergent which contain large part of anion.

  (i) For preparing anionic detergent, long chain alcohols are first treated with concentrated H_2S, giving alkyl hydrogen sulphates. These are neutralized with alkali to give anionic detergent.

  (ii) They are also effective in slightly acidic solutions. In acidic solution, they form alkyl hydrogen sulphate which is soluble in water whereas soaps form insoluble fatty acids.

(b) **Cationic detergents** are mostly acetates or chlorides of quaternary amines. These detergents have germicidal properties and are extensively used as germicides.

(c) **Non-ionic detergents** are esters of high molecular mass.

CELL AND TISSUE

The cell is the basic living unit of all organisms. The simplest organisms consist of a single cell whereas humans are composed of trillions of cells.

The cell theory proposed by J.M. Schleiden and T. Schwann, states that organisms are composed of cells and cell is the basic unit of life. Rudolf Virchow proposed that all cells arise by division of prexisting cells.

Every cell is surrounded by a plasma membrane that forms a cytoplasmic compartment. The plasma membrane is selectively permeable and serves as a selective barrier between the cell and its surrounding environment.

Prokaryotic cells are bounded by a plasma membrane but have little or no internal membrane organization. They have a nuclear area rather than a membrane-bounded nucleus. Prokaryotes typically have a cell wall and ribosomes and may have propeller-like flagella. Prokaryotes lack membrane bound organelles. Thus cell organelles like mitochondria, golgi bodies, endoplasmic reticulum are all absent in prokaryotes.

Eukaryotic cells have a membrane-bounded nucleus and cytoplasm, which is organized into organelles; the fluid component of the cytoplasm is the cytosol.

- Plant cells differ from animal cells in that they have **rigid cell walls, plastids, and large vacuoles**; cells of most plants lack centrioles.
- Membranes divide the cell into membrane-bounded compartments; this allows cells to conduct specialized activities within small areas of the **cytoplasm**, concentrate molecules, and organize metabolic reactions. A system of interacting membranes forms the endomembrane system.

  The **nucleus** is the control center of the cell and contains genetic information coded in DNA.
- The nucleolus is a region in the nucleus that is the site of ribosomal RNA synthesis and ribosome assembly.

  The **endoplasmic reticulum** (ER) is a network of folded internal membranes in the cytosol.
- **Rough ER** is studded along its outer surface with ribosomes that manufacture proteins.
- **Smooth ER** is the site of lipid synthesis and detoxifying enzymes.

  The **Golgi complex** consists of stacks of flattened membranous sacs called cisternae that process, sort, and modify proteins synthesized on the ER.

  Lysosomes function in intracellular digestion; they contain enzymes that break down both worn-out cell structures and substances taken into cells.

  Peroxisomes are membrane-bounded sacs containing enzymes that catalyze a variety of reactions in which hydrogen peroxide is formed as a byproduct.

  Vacuoles are important in plant growth and development. Many protists have food vacuoles and contractile vacuoles.

  Mitochondria, the sites of aerobic respiration, are double membraned organelles in which the inner membrane is folded, forming cristae that increase the surface area of the membrane.
- Mitochondria contain DNA that codes for some of its proteins.

  Cells of algae and plants contain plastids; **chloroplasts**, the sites of photosynthesis, are double-membraned plastids.
- Chlorophyll, the green pigment that traps light energy during photosynthesis, is found in the chloroplast.

  The cytoskeleton is a dynamic internal framework made of microtubules, microfilaments, and intermediate filaments. The cytoskeleton provides structural support and functions in various types of cell movement, including transport of materials in the cell.
- Cilia and flagella function in cell movement. Each consists of a 9 + 2 arrangement of microtubules.

FUNCTIONS OF THE CELL

(i) The cell is the smallest part to which an organism can be reduced that still retains the characteristics of life.

(ii) Cells produce and secrete various molecules that provide protection and support to the body.

(iii) All the movements of the body occur because of specific cells called muscle cells.

(iv) Cells produce and receive chemical and electrical signals that allow them to communicate with one another.

(v) Each cell contains a copy of the genetic information of the individual within the nucleus. Specialized cells (gametic cells) are responsible for transmitting that genetic information to the next generation.

CELL WALL

In plant cells a dead layer is also present outside the cell membrane called as **cell wall**. It is made up of cellulose and is permeable to water, solutes and gases.

Functions of the cell wall

(i) It helps in maintaining/determining cell shape.

(ii) It provides support and mechanical strength to plants.

(iii) It protects the cell against mechanical injury and pathogens.

(iv) It helps in transport of various substances across it.

(v) It helps the plant cells to withstand a lot of variations in the surrounding environment.

(vi) It prevents bursting of cell on endosmosis.

Transport of substances across the membrane

The transport of substances across the plasma membrane can be of two types depending upon the expenditure of energy.

1. **Passive transport :** The transport of substances across the membrane which does not require expenditure of energy is called passive transport. It is of two types-

(i) **Diffusion :** The process of movement of substances from the region of higher concentration to the region of lower concentration so as to spread the substance uniformly in the given space is known as diffusion.

For example: Transport of CO_2 and O_2 across the membrane.

(ii) **Osmosis:** Diffusion of water from a region of higher concentration to a region of lower concentration across the semipermeable membrane is called osmosis.

For example : Movement of water across selectively permeable membrane.

Types of osmosis :

(a) **Endosmosis:** Movement of water inside a cell.

(b) **Exosmosis:** Movement of water out of the cell.

2. **Active transport:** The process of transport of molecules across the plasma membrane against the concentration gradient requires energy and is known as active transport.

   For example: The transport of glucose, amino acids and ions occurs through active transport.

TISSUES

- Group of cells having a common origin and performing similar functions are called tissues.
- A meristematic tissue is a group of similar cells that are in a continuous state of division. These tissues are in general called **meristems.**
- The meristematic cells when lose their power of division differentiate into **permanent tissues.** The cells of these tissues are either living or dead, thin walled or thick walled.

MICROORGANISMS

- Microorganisms are very tiny organisms which can be seen under microscope. Some example of microorganisms are **bacteria, virus, protozoa, fungi** and **algae.**
- Microorganisms range in size from 0. 015 μ to more than 100 micron.
- Microorganisms can be unicellular or multicellular. Bacteria, protozoans and some algae are unicellular while most of the algae and fungi are multicellular.
- Microorganisms can be autotrophic or heterotrophic. Some bacteria, few fungi and viruses are heterotrophes while algae and some fungi are autotrophes.
- Microorganisms can reproduce sexually, asexually or both.

VIRUSES

Viruses term is a latin word which means venom or poison.

Viruses are minute microorganisms much smaller than bacteria (size ranges from 0.015 – 0.2 micron) and can be seen only with the help of an electron microscope.

M.W. Beijerinck (1898) demonstrated that the extract of infected plants of tobacco causes infection in healthy plants and called the fluid as *contagium vivum fluidum*.

W.M. Stanley (1935) showed that viruses could be crystallised and crystals consist of proteins.

Characteristics of Viruses

- They are not free living.
- They grow and multiply only inside other living cells.
- Outside a living system, a virus is like a non-living substance. It neither respires nor reproduces outside the host.
- They are a link between living and non-living things.
- A virus is a nucleoprotein and the genetic material is infectious.
- The protein coat is called capsid that protects the DNA/RNA.
- Antibiotics have no effect on viruses as they do not have a metabolism of their own.
- Viruses found in plants are known as plant viruses. Similarly, they are categorised as animal viruses or bacterial viruses or *bacteriophages*.

Disease Causing Viruses (Harmful Viruses)

Many human diseases like influenza, common cold, measles, mumps, chicken pox, rabies, etc., are caused by viruses. One of the most fatal disease caused by a **HIV** (Human Immunodeficiency Virus) virus is **AIDS** (Acquired Immuno Deficiency Syndrome). It spreads through sexual contact with an infected person.

In 1971, T.O. Diener discovered very simple smallest infections agents called viroids. They contain only RNA, capsid is absent.

BACTERIA

- Bacteria have Autotrophic as well as Heterotrophic nutrition.
- Bacteria show both aerobic and anaerobic respiration.
- Saprophytic bacteria obtain their food from organic remains such as corpses; animal excreta, fallen leaves *etc*. *e.g. Pseudomonas*.
- Symbiotic bacteria form mutually beneficial association with other organisms. E.g. *Rhizobium* forms association with different legumes.
- *Escherichia coli* lives in human intestine and synthesises vitamin *B* and *K*.
- Parasitic bacteria draw their nourishment from other living organisms called hosts *eg. Vibrio cholerae* (causes cholera) *Salmonella typhi* (causes typhoid) *etc*.
- Bacteria reproduce asexually by binary fission under favourable conditions. The cell division is of simple type called amitosis. During unfavourable conditions, bacteria reproduce by endospore formation.
- Bacteria reproduces sexually by conjugation. It was first discovered by Lederburg and Tatum in *Escherichia coli*.
- Bacteria *Rhizobium* help in N_2 fixation in soil, they occur in root nodules of leguminous plants.

Cyano bacteria

- They are also known as blue green algae. They made the earth's atmosphere oxygenic. They are autotrophs and many of them fix atmospheric nitrogen as Ammonia with the help of structure called heterocyst.
- Representatives of this group are *Anabaena, Oscillatoria, Nostoc, Spirulina* etc.

Bacteria are not only harmful to us or to plants but these are very useful for human beings, animals and plant life.

1. Antibiotics are prepared from bacteria like streptomycin is prepared from *Streptomyces grisiens*. Chloromycin is prepared from *S. venezuelae*. Terramycin is prepared from *S. rimosus*. Penicillin was the first antibiotic discovered by Alexander Fleming in 1929.
2. Some bacteria are called nitrifying bacteria as they convert nitrogen of ammonia (NH_3) into nitrates.
3. Bacterium lactic acid (*Lactob* a *cillus sp*) are found in milk, which convert lactose sugar of milk into lactic acid, because of which milk becomes sour.
4. Bacteria are useful in vinegar industry. Vinegar is made from sugar solution in the presence of *Acetobacter aceti*.
5. In Gobar Gas plants cow-dung as well as other excreta are collected and subjected to bacterial action. The bacterial degradation of cellulose releases inflammable gases consisting mainly of methane. The gas is used for domestic cooking.

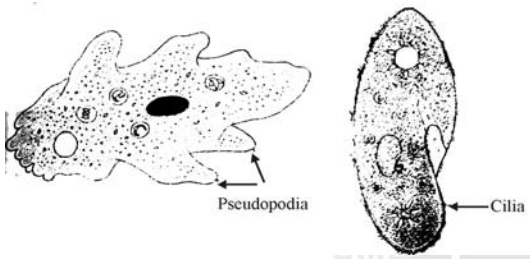
MYCOPLASMA

Simplest and smallest known microbes, next to virus, are the *Mycoplasmas*. Mycoplasmas are bacteria that lack cell wall. Due to absence of cell wall they are not affected by many common antibiotics. They do not have any particular shape and grow as saprophytes or parasites causing diseases in plants and animals.

- Mycoplasmas are known to cause *pleuro-pneumonia* in cattle and witche's broom in plants.

PROTOZOA

- Protozoa are a group of single celled eukaryotic organisms which are classified as animals. The mode of nutrition is heterotrophic and show motality. Some examples are : *Amoeba*, *Paramecium*, *Trypanosoma*, *Entamoeba* and *Plasmodium*.



(a) *Amoeba* (b) *Paramecium*

- Some protozoans like *Amoeba, Paramecium, Euglena* etc have contractile vacuoles for osmoregulation.
- Asexual reproduction is by binary fission **(e.g *Amoeba, Paramecium, Euglena)*** or by multiple fission (e.g ***Plasmodium*** and ***Amoeba***)
- Paramecium is known as slipper animalcule.
- Sir Ronald Ross (1896) was the first to observe oocytes of *Plasmodium* in female *Anopheles* (mosquito).
- Laveran (1880) discovered that malaria is caused by a protozoan parasite, *Plasmodium vivax*.

Useful effects of Protozoa

- Protozoa help considerably in the treatment of waste and sewage because they feed on fungi and bacteria which decompose organic matter.
- Being simplest animal they are used as laboratory animals for research.
- *Entamoeba* lives in the large intestine of humans and feeds on the lining and causes amoebic dysentery (pain in the abdomen and repeated motions).
- *Trypanosoma* lives in the blood stream of human beings, cattle and wild animals cause a disease known as sleeping sickness.

FUNGI

- Fungi are non-green hence **heterotrophic** in their mode of nutrition. They may be saprophytes (growing on dead organic matter) or parasites (drawing food from living plants and animals as their hosts) or a few are symbiotic (living with co-host in symbiosis), as in lichens.
- Fungi are eukaryotes with cell walls containing chitin. Most fungi reproduce both sexually and asexually by means of spores. When a fungal spore lands in a suitable spot, it germinates.
- Imperfect fungi (deuteromycetes) lack a sexual stage. Most reproduce asexually by forming conidia.
- A lichen is a symbiotic combination of a fungus and a phototroph (an alga or cyanobacterium).

Economic importance of fungi

1. Mushrooms and Morels are edible fungi used as delicious vegetables all over the world. *Agaricus campestris* is common edible mushroom.
2. Some medicines are prepared from fungi. These medicines are penicillin, ergot, chaetomin and griseoflavin.
3. Alcohol and alcoholic drinks are produced by a process called fermentation of cereals by yeast *Saccharomyces*.
4. Yeast (*Saccharomyces cerevisiae*) is used in making bread, cakes, idli and dosa, etc. Yeast is rich in vitamin B (Riboflavin) and protein.
5. Some fungi are decomposers and are helpful in decomposing organic waste. This helps in recycling of nutrients in the biosphere.
   - *Rhizopus stolonifer* is the common bread mould fungus.
   - Some parasitic fungi cause diseases in plants. For example.
     Puccinia causes rust diseases in wheat, *Ustilago* causes smut disease in wheat.
   - *Albugo* causes white rust in mustard family.
   - *Aspergillus* causes a disease called aspergillosis in humans.
   - *Aspergillus flavus* produces a toxin aflatoxin which is carcinogenic and can potentially contaminate food such as nuts.

ALGAE

- Algae are water loving green plants found growing in almost all water places. The algal growth floats on water surface and looks like foam or soap lather. It is called water bloom : For example *Microcystics, Anabaena, Oscillatoria*, etc.

  Green algae : Algae are plants because they have chlorophyll, cellulosic cell wall and contain chlorophyll a, b and starch as reserve food. Examples are *Chlamydomonas*, *Volvox*, *Spirogyra*.

  Blue green algae (Cyanobacteria) : Contain phycocyanin (cyanin = blue) pigment in addition to chlorophyll. Examples are *Nostoc*, *Anabena*, *Oscillatoria*.

  Red algae: Contain phycoerythrin (erythrin = red) pigment in addition to chlorophyll a and d and phycocyanin.

  ***Example* :** *Polysiphonia*.

  Brown algae: Include fucoxanthin, carotene and xanthophyll in addition to chlorophyll to give brown colour to the plants. Examples are *Fucus* and *Laminaria*. Brown algae yields iodine.

  Diatoms: Contain a golden brown pigment called diatoxanthin in addition to chlorophyll a and c.

  Unicellular algae may be oval, spherical or elongated in shape and are microscopic in size.
- Several algal forms grow on other plants (algae, angiosperms) as **epiphytes**. For example *Oedogonium*, *Cladophora*, *Vaucheria*, etc.

- Some blue-green algae grow as **endophytes** inside other plants. For example *Anabaena* growing inside the leaf of *Azolla* (fern), *Nostoc* inside the thallus of *Anthoceros* (*hornwort*) and *Anabaena*, *Nostoc* and *Oscillatoria* inside the coralloid root of *Cycas*.
- Algae growing on the bodies of animals are described as **epizoic**. For example *Cladophora crispata* grows on snail shell.
- Algae growing inside the body of animals are called **endozoic**. For example *Chlorella* grows within the tissue of *Hydra*.
- *Cephaleuros virescens* grows as a parasite on tea leaves causing red rust disease of tea.

➤ **Useful Algae**

1. Algae are major source of food for organisms. A popular vegetable of Japan is prepared from *Laminaria*. *Chlorella* is an alga which contains more protein than the egg. Spirulina is also a good source of protein.
2. Agar is obtained from red algae. This product is used in laboratory for various experiments.

- *Laminaria digitata* and *Fucus* sp. are largely known for extraction of iodine hence used to treat goitre.
- Certain marine brown algae and red algae produce large amount of hydrocolloids (water holding substances). For example alginic acid extracted from *Laminaria*.

LIFE PROCESSES

Plants and animals both have important parts called organs that enable them to live. Organs are complex structures that have a specific function.

RESPIRATION

Respiration is a process where the body breaks down glucose with the help of oxygen. It is a part of metabolic process where energy molecule is released while carbon dioxide and water are produced.

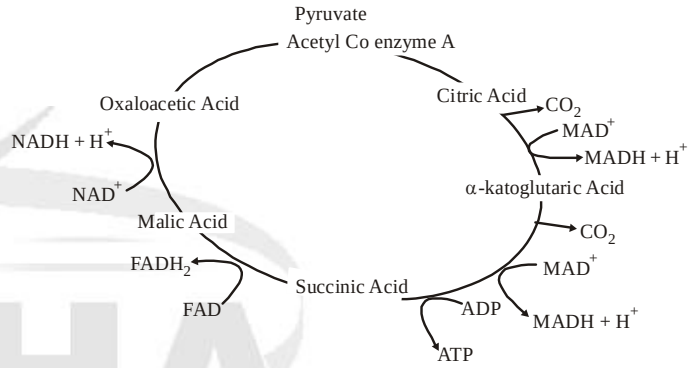
Energy contained in food is 'unlocked' or transferred to the organism by the process of respiration. Respiration takes place in the mitochondria of the cell.

Respiration may be divided into two categories :

(i) Aerobic respiration: It is a process of cellular respiration that uses oxygen in order to break down respiratory substrate which then releases energy.

Glycolysis occurs in cytoplasm of the cell. In this process, glucose undergoes partial oxidation to form two molecules of pyruvic acid.

Krebs cycle or citric acid cycle : It was discovered by Hans krebs in 1937. This is also known as tricarboxylic acid cycle (TCA cycle).



This cycle takes place in mitochondria and only in presence of oxygen yielding NADH and $FADH_2$.

$$\underset{(6-C\ compound)}{Glucose} \xrightarrow[In\ cytoplasm]{Glycolysis} \underset{(3-C\ compound)}{Pyruvic\ Acid}$$

$$\xrightarrow[\substack{In\ mitochondria\\ presence\ of\ O_2}]{Krebs\ cycle} CO_2 + H_2O + 38ATP$$

Respiratory Disorders

Disease	Characteristic	Prevention and cure
1. Bronchitis	Inflammation of Bronchitis Hyper plasia of sero-mucous glands and goblet calls. Regular coughing with thick greenish yellow sputum.	Avoid exposure to smoke, chemicals and pollutants. Take suitable antibiotics
2. Bronchial Asthama	Hyper sensitivity of Bronchiole. Coughing and difficulty in expiration	Avoid exposure to allergens
3. Emphysema	Inflammation of Bronchioles Lose of elasticity of alveolar sac	Avoid exposure to pollutant and avoid smoking
4. Pneumonia	Infection by Bacteria (*Streptococcus pneumoniae*) or some other bacteria or fungi	Vaccination and Antibiotics
5. Occupational lung disease	Exposure to harmful substances with such as gas, fires and dust, silica and asbestos	Minimise exposure to these chemicals. Use of protective wears and clothing by workers at work place, working in chemical factories.

(ii) Anaerobic respiration: It is a process of cellular respiration that takes place in absence of oxygen, there is incomplete breakdown of respiratory substrate and little energy is released.

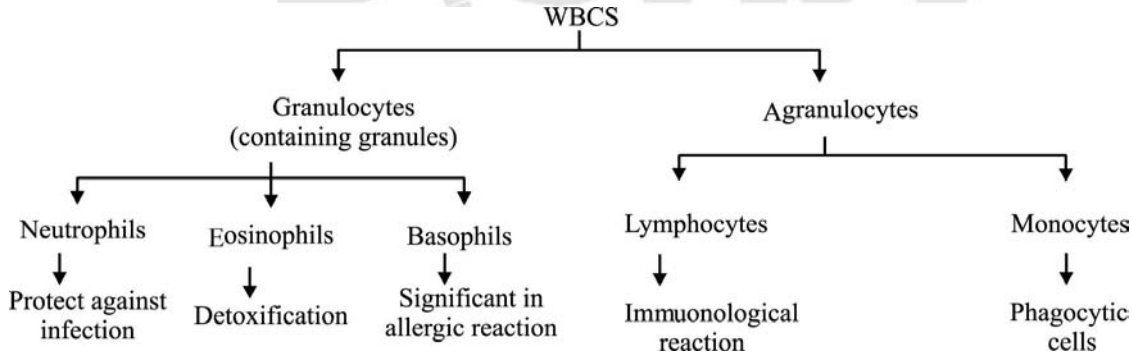
$$\underset{(6-C\text{ compound})}{\text{Glucose}} \xrightarrow[\text{In cytoplasm}]{\text{Glycolysis}} \underset{(3-C\text{ compound})}{\text{Pyruvic Acid}}$$

$$\xrightarrow[\text{In cytoplasm of muscle cells}]{\text{No oxygen}} \underset{(3-C\text{ compound})+2ATP}{\text{Lactic Acid}}$$

Respiration in Animals

	Respiratory organs	Animals/Animal groups
I.	Skin	Earthworm, leech, frog.
II.	Gill or Bronchin or Ctenidia	"Annelids (Arenicola); Crustaceans (Prawn, Crab); Molluscs (Pila, Unio); Protochordates, Fishes, Amphibians."
III.	Tracheas	Insects, Arachnids
IV.	Bucco-pharynx	Frog
V.	Lungs	Ambhibians, Reptiles, Birds and Mammals.

White Blood cells are categorised in the following types –



Blood Platelets : They facilitate blood clotting so as to prevent loss of body fluids.

HEART

The human heart is a muscular, cone shaped organ about the size of a fist. Heart is situated behind the sternum, between the lungs in the thoracic cavity. The human heart is four chambered. In human beings the blood circulation is called **double circulation** because the blood passes twice through the heart during one round of circulation.

Disorder of Circulatory System

Hypertension : Increase in the blood pressure. Normal b.p., must be 120/80 mm Hg. A continuous or sustained rise in the arterial blood pressure is known as hypertension

Atherosclerosis : It refers to the deposition of lipids (especially cholesterol) on the walls lining the lumen of large and medium sized arteries. This results in heart attack or stroke.

TRANSPORTATION

The coordinated process of carrying out proper distribution of materials as oxygen, water, minerals and organic food among the cells is called **transportation**.

Transportation in Animals

Transport system in animals is called the **circulatory system**.

Blood Circulatory System

There are two types of blood circulatory systems:

(i) Open circulatory system : The blood enters and circulates in the interstitial spaces (space between the tissues). The blood vessels are open-ended as they open into the common cavities called the **haemocoel**, *e.g.* insects.

(ii) Closed circulatory System: The blood always remains inside the blood vessels and never comes in direct contact with the cells.

BLOOD

Blood is liquid connective tissue.

Composition of Blood

Plasma : It is the pale yellowish fluid with a total volume of 2-3 litres in a normal adult. Its contents are 90% water and the rest 10% includes protein, inorganic ions and organic substances.

Red Blood Cells (Erythrocytes) : These are red in colour, due to the presence of haemoglobin. They do not have a nucleus.

White Blood Cells (Leucocytes). They are responsible for the defense system in the body. WBCs are colourless, without haemoglobin.

Arterio sclerosis : Calcium salts precipitate with cholesterol to harden the deposition and thickening of arteries. It may lead to rapture of wall, blood clot formation or thrombosis. Thrombosis may lead to heart attack and even death.

Heart failure : Loose in effective blood pumping by heart. It is also called congestive heart failure.

Cardiac arrest : Sudden damage of heart muscles, which cause stopping of heart beat. Also known as heart attack.

Angina : Also called Angina pectoris. It is caused due to unavailability of enough oxygen to the heart muscles.

NERVOUS SYSTEM

The nervous system is concerned with receiving stimuli from the external or internal environment of the body, interpreting the stimuli and producing the appropriate response to these stimuli.

Neuron. The unit of nervous system. The neuron is a special cell which can receive and conduct impulses.

ENDOCRINE SYSTEM IN HUMAN BEINGS

The chemical carrying the message is called hormone and the group of specialised cells which secrete these hormones is called endocrine glands.

Table-Endocrine System : Hormones and their actions

S. No.	Endocrine gland	Location	Hormone (GH)	Action
1.	Pituitary (Master glands)	Base of fore brain, pea shaped	Growth hormones (GH), Anti-Diuretic Hormone (ADH) Adenocorticotropic Hormone (ACTH) Thyroid Stimulating Hormone (TSH) Lutinizing Hormone (LH) Follicle Stimulating Hormone (FSH)	Regulates the growth of the body. Controls the amount of water reabsorbed by the kidney. Stimulates the synthesis and secretion of steroid hormones. Stimulates the synthesis and secretion of thyroxine hormone from the thyroid gland, glucocorticoids. Stimulates ovulation of fully mature follicles. (Follicle stimulating hormone stimulates ovary to produce female hormone).
2.	Pineal	In the brain	Melatonin	Melatonin helps in maintaining the normal rhythm of sleep-wake cycle, body temperature and also influences metabolism, pigmentation, menstrual cycle and defense capability.
3.	Thyroid	Neck of the lower extremity of larynx, butterfly shaped	Thyroxine	Regulates rate of growth and metabolism. Controls the metabolism of carbohydrates, proteins and fats and influences maintainance of water and electrolyte balance.
4.	Thymus	Behind breast bone	Thymosin	Helps in production of antibodies and differentiation of T-lymphocytes.
5.	Adrenal	A pair of cap shaped organs above each kidney	Cortisol Adrenalin and Noradrenalin	Involved in carbohydrate metabolism. Stress hormones, increase heartbteat, the strength of heart contraction and rate of respiration.
6.	Pancreas	Below the stomach, heterocrine gland	Insulin	Regulates sugar metabolism. Too little insulin leads to high sugar level in blood and weakness (a condition called diabetes).
7.	Ovary	Lie on the lateral walls of the pelvis	Estrogen (Progesterone)	Development of secondary sexual characters e.g. development of breasts in female. Supports pregnancy.
8.	Testis	In the scrotum	Testosterone	Development of many masculine features such as growth of moustaches and beard.

HEALTH & HYGIENE

- According to World Health Organisation (WHO) health is defined as "a state of complete physical, mental and social well being and not merely the absence of disease.
- **Hygiene is defined as the science and practice of maintaining good health**. It requires caring of one's own body and the immediate surroundings. The major aspects of personal hygiene are cleanliness, physical exercise, rest, sleep and healthy habits.
- **Community and Personal health :** Community health can be defined as "**all the personal health along with the environmental services for the importance of health of community**."
- **Disease may also be defined as morphological (structural), physiological (functional) or psychological disturbance in the body or body parts caused by some external agencies which may be non-parasitic (e.g. deficiency of nutrients) or may be parasitic (caused by viruses, bacteria, fungi, etc.).** Disease causing micro-organisms are known as **pathogens**.

VITAMIN MALNUTRITION :

Vitamin form very little part of diet but are very important from functional point of view. Deficiency of one or more vitamins can be seen in the form of clear symptoms.

1. VITAMINS AND HEALTH

Vitamin	Function	Food sources	Deficiency symptoms
Water-Soluble Vitamins			
Thiamine (vitamin B_1)	Growth, fertility, digestion,	Pork, beans, peas, nuts,	Beriberi (neurological disorder)
Riboflavin (vitamin B_2)	Energy use	Leafy vegetables, dairy products	Hypersensitivity of eyes to light
Folic acid	Manufacture of red blood cells, metabolism	dark green vegetables	Anemia, cancer
Cyanocobalamin (vitamin B_{12})	Manufacture of red blood cell, growth, cell maintenance	Meat, organ meats, fish, shellfish, milk	Pernicious anemia
Ascorbic acid (vitamin C)	growth, tissue repair, bone and cartilage formation	Citrus fruits, tomatoes, strawberries	Weakness, gum bleeding (scurvy)
Fat-Soluble Vitamins			
Retinol (vitamin A)	Night vision, new cell growth	Dairy products, egg yolk, vegetables, fruit	Night blindness, rough dry skin
Cholecalciferol (vitamin D)	Bone formation	Fish-liver oil, milk	Skeletal deformation (rickets)
Tocopherol (vitamin E)	Prevents certain compounds from being oxidized	Vegetable oil, nuts, beans	Anemia in premature infants
Vitamin K	Blood clotting	Egg yolk, green vegetables	Bleeding, liver problem

2. BULK MINERALS IN THE HUMAN DIET

Mineral	Food sources	Functions in the human body
Calcium	Milk products, green leafy vegetables	Bone and tooth structure, blood clotting, hormone release, nerve transmission
Phosphorus	Meat, fish, eggs, poultry, whole grains	Bone and tooth structure
Sodium	Table salt, meat, fish, eggs, poultry, milk	Body fluid balance, nerve transmission, muscle contraction

3. TRACE MINERALS IMPORTANT TO HUMAN HEALTH

Mineral	Food sources	Functions in the human body
Fluorine	Water (in some areas)	Maintains dental health
Iodine	Seafood, iodized salt	Part of thyroid hormone
Iron	Meat, fish, shellfish, egg yolk, peas, beans, dried fruit, whole grains	Transport and use of oxygen (as part of haemoglobin and myoglobin), part of certain enzymes.
Zinc	Meat, fish, egg yolk, milk, nuts, some whole grains	Part of certain enzymes, nucleic acid synthesis

PROTEIN MALNUTRITION

Due to poverty, people can't include appropriate quantity of protein in their diets and suffer from malnutrition.

- Protein deficiency causes **Kwashiorkar** disease in children in which body swells due to inflammation. Patient does not feel hungry and becomes irritated. Skin becomes yellow, dry and fragile with black spots.

TYPES OF DISEASES

Diseases are broadly classified into two categories, congenital (genetic) and acquired.

(i) **Congenital Diseases :** Congenital diseases are caused due to defective development of embryo or defective inheritance, e.g. haemophillia, colour blindness.

(ii) **Acquired Diseases :** These diseases develop after birth. Acquired diseases are of two kinds, *infectious* and *noninfectious*.

(a) **Infectious/Communicable diseases :** These diseases are caused by pathogenes/infectious agents such as bacteria, viruses, fungi, protozoans, worms, etc. These diseases can spread from diseased person to healthy person by means of air (droplet method), water, food, insects, physical contact, etc. e.g., tuberculosis, malaria, diarrhoea, etc.

(b) **Non-infectious/Non-communicable diseases :** They are diseases which remain confined to a person. They are neither present at birth nor spread form one person to another. The diseases are caused due to some specific factors. They many be caused due to **improper functioning of an organ** (short sightedness, hypertension, arthritis), hormonical imbalance (diabetes, dwarfism), allergy, cancer, inadequate diet (anaemia, goitre), etc.

MEANS OF SPREAD

Communicable diseases may be transmitted from the source of infection to susceptible individual in many different ways:

(i) **Direct Transmission**

(a) **Direct contact :** Infection may be transmitted by direct contact from skin to skin, e.g.,diseases transmitted by direct contact include leprosy, skin diseases and eye infections (like conjunctivitis)

(b) **Droplet infection :** Direct project of a spray of droplets of saliva during coughing, sneezing, speaking and spitting, e.g., whooping cough, tuberculosis, diphtheria, common cold.

(ii) **Indirect Transmission**

This embraces a variety of mechanisms including the traditional five F's – flies, fingers, fomites, food and fluid.

(a) Transmission of micro-organism through water and food (vehicle-borne transmission), e.g., acute diarrhoea, typhoid, cholera, polio, hepatitis A, food poisoning and intestinal parasites all are transmitted by water and food.

(b) Fomites include contaminated inanimate object for example soiled clothes, towels, handkerchiefs, cups, spoons, toys. Diseases transmitted by fomites–diptheria, eye and skin infection.

(c) **Vector borne transmission** occurs when the infectious agent is conveyed by an insect to a susceptible host, Mechanical transmission of the infectious agent through an insect occurs by houseflies. In some cases the infectious agent multiples in the insect (biological transmissions) and then is transported to susceptible host. For example transmission of malaria by mosquito. Another way is dissemination of microbial agent by air to a suitable portal of entry, usually the respiratory tract. Dust is responsible for this kind of transmission.

GENERAL PREVENTIVE MEASURES

(a) **Safe drinking water :** Drinking water should be filtered to remove suspended particles and boiled, ozonized and treated with chlorine before drinking to avoid water borne diseases like typhoid, cholera, hepatitis etc.

(b) **Proper disposal of waste :** Garbage should not be dumped here and there rather it should be thrown in covered garbage cans and burnt or buried for disposal. Sewage carrying drains should be covered.

(c) **Control of vectors :** Growth and breeding of animals like mosquitoes, rats, flies, cockroaches should be controlled by keeping surroundings clean, spraying insecticides, removing stagnant water from populated areas.

IMMUNITY

It involves circulatory system. It is the strongest of the body's defence mechanisms.

(a) **Natural immunity :** Natural immunity can be acquired by recovering from the attack of a disease. Once the body has suffered an infection and has learned to make antibodies against it, the body retains this ability even though it ceases making the antibodies. Thus when infection occurs again, the body quickly resumes making antibodies against it.

(b) **Acquired immunity :** Transmitting mild form of microbes of a disease to a healthy person is vaccination. It gives an artificially acquired form of active immunity. Vaccine acts as antigen which stimulates the inoculated person to produce antibodies which prevents healthy person from the disease against which he has been inoculated. The ability to make antibodies is retained for many years though not for life.
Children are regularly vaccinated against diptheria, tetanus, whooping cough, polio and small pox. Vaccines for cold, influenza, measles and rabies have been developed. All vaccines whether they contain germs or their toxins are antigens, there main purpose is to stimulate the body to produce antibodies.

VIRAL DISEASES

(a) **Jaundice or hepatitis**

Hepatitis or liver inflammation is a disease related to liver. The cause of this diseases is *hepatitis* virus, it propagate through **contaminated water, food or injected needle**. Hepatitis may be of A, B, C, D, E or G type but A and B are more infectious. Incubation period for this disease is 15 to 80 days. High fever, cold, headache, nausea, vomiting and weakness are the symptoms. Dark yellow urine and light yellow faeces are main symptoms of this disease.

(b) **Rabies :** The cause of this disease is a *Rhabdo virus*. This disease propagates by **biting of infected dog, cat, wolf, monkey etc.** High fever, intense headache, contraction of throat and chest muscles with pain, excessive secretion of saliva and restlessness are the primary symptoms of the diseases. Since patient develops fear for water, the disease is also called as **Hydrophobia.**

(c) **Polio :** The cause of this disease is a *Entero virus*. It is propagated through contaminated food, milk and water. Polio or poliomyelitis is a dangerous disease of children.

Child suffers paralysis due to damage of central nervous system. **Oral polio** vaccine is the best preventive measure of polio.

(d) **Chicken pox :** The cause of this disease is a Virus, known as *Varicella zoster*. It propagates through contact with a patient or scab.

Patient suffers fever, headache and loss of appetite. Dark red spots appear on back and chest, soon these spots get filled up with water and convert into blisters. Blisters dry after some days and scabbing get started. This is the infectious stage of the disease.

(e) **Measles :** This is a highly infectious disease of children. It propagates through indirect contact or through air. The cause of this disease is *Rubella virus*.

Patient gets sore throat due to cold. Red grains appear on face after 4-5 days and after wards spread on entire body. For prevention **MMR vaccination** should be done.

(f) **Dengue :** This is a dangerous disease caused by Dengue virus. It spreads by mosquito *Aedes aegypti*.

Main symptoms are high fever, headache, soreness of eyes and joints and pain in stomach due to convulsions. On growing intensity of disease bleeding starts from nose, mouth, and gums. Patient may vomit with or without blood.

(g) **Ebola virus disease:** Ebola is a severe and often deadly disease caused by a virus called Ebola virus. It can occur in humans and other primates (monkey, chimpanzee and gorillas).

Symptoms: Fever, chills, severe headache, muscle pain, weakness, diarrhea, vomiting, bleeding and often death.

Occurrence: Ebola was discovered in 1976 near the Ebola River in the Democratic republic of the Congo.

Since then several outbreaks have occurred in Africa. The 2014 outbreak is the largest. The countries affected in this recent outbreak include Guinea, Liberia, Sierra, Leone. In 2014 (October) WHO declared both Nigeria and Senegal free of Ebola virus transmission.

Transmission: Spread by direct contact with infected body fluids including but not limited to urine, saliva, sweat, feces, vomit, breast milk and semen. The virus can enter the body through a break in the skin or through mucous membranes, including the eyes, nose and mouth. It can also spread by contact with any surface, objects and materials that have been in contact with body fluids from a sick person such as clothing bandages, medical equipment, needles, syringes etc.

AIDS

Full name is **Acquired Immuno Deficiency Syndrome.** It is a severe, life threatening disease, first recognized in 1981. The causative organism of this disease is (HIV-1 and HIV-2). "Human immune deficiency virus" which is a '*Retro virus*'.

HIV attacks the immune system by destroying $CD4^+$ T cells, a type of white blood cell that is vital to fighting off infection. The destruction of these cells makes people vulnerable to other diseases and infections and may ultimately lead to death of the patient.

A person is diagnosed with AIDS when the count of $CD4^+$ T cells goes below 200 cells per ml^3 of blood.

The virus is transmitted from an infected person to a healthy person mainly through sexual contact and exposure to blood or tissues, or transplacental transmission from an infected mother to the foetus.

lst case in 1981 America; lst case in India 1986, Chennai.

Symptoms : Swollen lymph nodes, Decreased count of blood platelets causing hemorrhage and fever, severe damage to brain which may lead to loss of memory, ability to speak and even think.

Treatment: Their is no specific treatment. Foetal infection can be reduced by using anti -HIV drug to reduce transmission of virus to the foetus of pregnant mothers.

Drugs used

(1) AZT (Azido thymidine)
(2) DD I (Dideoxyinosine)

These drugs inhibit the enzyme reverse transcriptase of HIV.

DISEASES CAUSED BY BACTERIA

(a) **Tuberculosis (T.B.) :** Tuberculosis (T.B.) was first discovered by Robert Koch in 1882. It is an infectious disease which is communicated from one human being to another directly or indirectly. Tuberculosis may also be contracted from animals. It is caused by a bacterium-called *Mycobacterium tuberculosis*. The bacterium releases a toxin called **tuberculin**. In T.B., the patient feels sick and weak. There is a loss of appetite and weight. Typical fever pattern and night sweats are also common.

Child must be vaccinated for B.C.G. within few hours after birth. Antituberculosis (ATT) and DOTS treatment methods are available.

(b) **Typhoid :** Typhoid is caused by the bacteria *Salmonella typhi* commonly found in intestine of man. Human infection is direct and the bacteria are spread through faecal matter by house flies, etc.

Symptom of this disease is continuous increase in body temperature for a week. Second week temperature remains constant. Meanwhile red grains appear on stomach. Body temperature decreases during 3^{rd} and 4^{th} weeks.

TAB-vaccination provides immunity for three years. **Oral Typhoid Vaccine** (OTV) is also available. Patient can take antibiotics drugs on advice of a doctor.

(c) **Tetanus :** It is fatal disease caused by bacterium *Clostridium tetani*. These bacteria grow on fertile soil, dung etc. and enter human body through wounds or cuts on body. The cause of the disease is a toxic secretion from bacteria known as *Tetanospasmin*.

Due to this cramps start on back, jaws and neck. In intense condition entire body contracts in shape of a bow. In the end patient can't respire due to cramps in neck muscles and dies painfully.

For prevention **D.P.T.** vaccine dose is given to infants. To save infants from infection mothers should be vaccinated compulsorily.

DISEASE CAUSED BY PROTOZOA

Malaria : Malaria is caused by a protozoan parasite *Plasmodium*. This spreads through the bite of an insect vector-female anopheles mosquito which feeds on human blood. (male anopheles mosquito feeds upon plant juices).

Headache, nausea, muscular pains and high fever are the main symptoms of malaria. Malaria may also secondarily cause enlargement of spleen and liver.

Larvivorous fishes like *Gambusia, Minnows,* Trouts should be kept in large water bodies. These fishes feed on mosquito larvae and help us. Mosquito repellents can also be used. Patient can be given drugs like *quinine, chloroquine, primaquine, peludrine* etc. on advice of a doctor.

Antibiotic

- Antibiotic is a substance produced by a living organisms which is toxic (poisonous) for other living organisms, specially for the germs (Bacteria). In the year 1928, Sir Alexander Fleming while studying bacteria in a culture being prepared in his laboratory found that bacteria did not grow around a green mould, *Penicillium notatum*, which was also present in the culture. This was the first antibiotic discovered and extracted and named as penicillin.
- **Antiseptic :** Joseph Lister, an English surgeon found that pus formation in a wound is reduced or checked when it is immediately cleaned with carbolic acid. He named carbolic acid as antiseptic. He also introduced the system of boiling and washing surgical instruments with carbolic acid and cleaning hands with carbolic soap. This practice killed germs and it was termed as 'sterilization'. Later alcohol, chlorination and solution of potassium permanganate also came into use for sterilization.
- **Vaccine :** It was British Physician, Edward Jenner who noticed that milkmaids often contracted mild infection of 'cow pox' and also found that once a maid has suffered from cow pox gets immune to cowpox and small pox. Jenner collected cow-pox fluid from one patient and pushed it into the blood of a healthy cowboy. The infected cowboy got ill for 2 to 3 days only and had become immune to small pox for life. The fluid from cow-pox was termed as vaccine (vacca meaning cow in latin). The process of injecting vaccine in a healthy person is termed as vaccination. Resistance to disease for the future is called immunisation.

Types of vaccines

First generation vaccines: These vaccines are prepared by inactivating the whole pathogen. These vaccines have been effectively used to control a number of diseases.

For egs : Influenza, measles, rubella, cholera, polio

Second generation vaccine: These vaccines use only the specific part (the antigen) of the pathogen. Antigenic polypeptides of pathogens are produced with recombinant DNA technology.

For Example Hapitites B

Third generation vaccines : These are the most recent vaccines called DNA vaccines in which either naked DNA is used directly or packaged in a recombinant virus or bacteria.

Vaccine	Protect against	Given at
5 in one vaccine	Diptheria, tetanus, whooping cough Polio & Hib (Haemophilum influenzae)	2, 3, 4 months of age
Pneumococcal (PCV)	Pneumococcal infection	2, 4, & 12 - 13 months of age
Rotavirus	Rotavirus infection (childhood diarrhoea and sickness)	2 -3 months of age
Meningitis C (Men C)	Meningitis C	3, & 12-13 months of age and a teenage booster at 13-15 years
MMR	measles, mumps and rubella	12-13 months & 3 years 4 months of age
4 in one preschool booster	Diptheria, tetanus, whooping cough and polio	3 years 4 months of age.

BIODIVERSITY

- Biodiversity is the term popularised by the sociobiologist Edward Wilson to describe the combined diversity at all the levels of biological organisation.

The most important of them are–

(i) **Genetic diversity :** A single species might show high diversity at the genetic level over its distributional range. The genetic variation shown by the medicinal plant *Rauwolfia vomitoria* growing in different Himalayan ranges might be in terms of the potency and concentration of the active chemical (reserpine) that the plant produces. India has more than 50,000 genetically different strains of rice, and 1,000 varieties of mango.

(ii) **Species diversity:** The diversity at the species level. For example, the Western Ghats have a greater amphibian species diversity than the Eastern Ghats.

(iii) **Ecological diversity:** At the ecosystem level, India, for instance, with its deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows has a greater ecosystem diversity than a Scandinavian country like Norway.

BIODIVERSITY CONSERVATION

Biodiversity conservation may be in situ as well as ex situ. In in situ conservation, the endangered species are protected in their natural habitat so that the entire ecosystem is protected. Recently, 34 'biodiversity hotspots' in the world have been proposed for intensive conservation efforts. Of these, three (Western Ghats-Sri Lanka, Himalaya and Indo-Burma) cover India's rich biodiversity regions. Our country's in situ conservation efforts are reflected in its 18 biosphere reserves, 112 national parks, > 515 wildlife sanctuaries and many sacred groves. Ex situ conservation methods include protective maintenance of threatened species in zoological parks and botanical gardens, in vitro fertilisation, tissue culture propagation and cryopreservation of gametes.

THREATENED SPECIES CONCEPT

The International Union for Conservation of Nature and Natural Resources (IUCN), have its head quarters at Morgis in Switzerland and maintains a Red Data Book that provide a record of animals and plants which are known to be in danger. In India the Wildlife (Protection) Act, 1972 provides four schedules categorising the fauna of India based on their conservation status. Schedule 1 lists the rare and endangered species which are afforded legal protection. For the purpose of conservation species are categorized as below:

Threatened (T) : The term is used in context with conservation of the species which can be anyone of the above 3 categories.

Threatened = Endangered + Vulnerable + Rare

1. **Endangered (E) :** Those species which are in the immediate danger of extinction and whose survival is unlikely, whose number have been reduced to a critical level, if the casual factors continue to be operating.
2. **Vulnerable (V) :** The species likely to move into the endangered category in the near future if the casual factors continue to operate. Their population is still abundant but are under threat throughout their range.
3. **Rare (R) :** These are species with small population in the world. These are not at present endangered and vulnerable, but are at risk due to their less number. These species are usually localised within restricted geographical areas or habitats.

BIOSPHERE RESERVES

It is a specified protected area in which multiple use of the lands are permitted.

There are 3 zones of biosphere reserve.

1. **Core zone :** It lies at the centre where no human activity is allowed.
2. **The Buffer zone :** Where limited human activity is allowed.
3. **Manipulating zone or Transition zone:** Where a large number of human activities would go on.

Note: In India following 18 sites have been identified as potential biosphere reserves together with their locations:

	Biosphere Reserve	States
1.	Nanda Devi	Uttaranchal
2.	Nokrek	Meghalaya
3.	Manas	Assam
4.	Dibru Saikhowa	Assam
5.	Dehang Debang	Arunachal Pradesh
6.	Sunderbans	West Bengal
7.	Gulf of Mannar	Tamil Nadu
8.	Nilgiri	Kerala, Karnataka and Tamil Nadu
9.	Great Nicobar	Andaman & Nicobar
10.	Simlipal	Orissa
11.	Kanchanjunga	Sikkim
12.	Pachmarhi	Madhya Pradesh
13.	Agasthyamalai	Kerala
14.	Achankamar	Madhya Pradesh, Chattisgarh
15.	Great Rann of Kutch (2008)	Gujarat
16.	Cold desert (2009)	Himachal Pradesh
17.	Seshachalam hills (2010)	Andhra Pradesh
18.	Pauna (2011)	Madhya Pradesh

NATIONAL PARKS AND MAIN SANCTUARIES IN INDIA

National Parks : In national parks both plants and animals are protected. There are 112 National Parks which occupy about 1.21% of the country's total surface area.

Sanctuaries : There are 515 wildlife Sanctuaries.

India's Famous Tiger Reserve

* Jim Corbett National Park – Nainital (Uttaranchal)
* Dudhwa National Park – Lakhimpur Kheri (U.P.)
* Kanha National Park – Mandala and Salghat (Madhya Pradesh)
* Indrawati National Park – Chattishgarh
* Simli National Park – Orissa

GENETICALLY MODIFIED CROPS

Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms (GMO).

A transgenic crop is a crop that contains and expresses a transgene (genetically modified gene). This crop is known as genetically modified crops or GM crops.

Two unique advantages :

(i) Any gene (from any organism or a gene synthesised chemically) can be used for transfer, and

(ii) The change in genotype can be precisely controlled since only the transgene is added into the crop genome. For example - Hirudin is a protein that prevents blood clotting. The gene encoding hirudin was chemically synthesized and transferred into *Brassica napus*, where hirudin accumulates in seeds. The hirudin is purified and used in medicine.

A soil bacterium *Bacillus thuringiensis*, produces crystal [Cry] protein. This Cry protein is toxic to larvae of certain insects.The gene encoding cry protein is called cry gene. This Cry protein is isolated and transferred into several crops. A crop expressing a cry gene is usually resistant to the group of insects for which the concerned Cry protein is toxic.

BIOFERTILIZERS

Micro-organisms (bacteria, fungi and cyanobacteria) employed to enhance the availability of nutrients like nitrogen (N), and phosphorus (P) to crops are called biofertilisers. Several micro-organisms fix atmospheric nitrogen and make them available to plants.

Examples of nitrogen-fixing micro-organisms are bacteria and cyanobacteria (blue-green algae); some of these are free-living, while others form symbiotic association with plant roots. Rhizobia form root nodules in legume crops and some cyanobacteria (blue-green algae) form symbiotic association with the fern **Azolla**.

The fungus and plant root association is called mycorrhiza. Some of these fungi are present on root surface only, whereas others enter into the roots as well. These fungi solubilise phosphorus, produce plant growth promoting substances and protect host plants from soil pathogens.

Biofertilisers are a low-cost input and they do not pollute the environment. They also reduce the dependence on chemical fertilisers and also help to use organic farming.

ACHIEVEMENTS OF GENETIC ENGINEERING

The DNA recombinant technology or genetic engineering provides great benefits for advancement of science and society.

(1) A new system of medicine gene therapy, may develop to treat hereditary diseases such as haemophilia. Genetic disorder can be over come by introducing specific gene.

(2) Bacteria may be used as "living factories" for synthesizing vitamins, hormones and antibodies.

* Human insulin (Humulin) was first genetically engineered product produced by an American firm Eli Lilly - 5th July 1983.
* Charles Weismann of university of Zurich, obtained interferon through recombinant *E.coli* (1980) Microbes have been engineered to produce human growth hormone (HGH) for curing dwarfism.
* Vaccines which are produced by genetic engineering e.g., for Hepatitis-B and Herpes virus.
* Nitrogen fixation genes may be transferred from bacteria to the major food crops to boost food production without using expensive fertilizers.
* Transgenic plant obtained through recombinant DNA technology. First transgenic plant was tobacco. It contains resistant gene against weedicide (Glyphosate).
* First transgenic animal was mouse containing gene for growth hormone.
* First introduced transgenic crop in India (2002) is Bt-cotton. It is resistant for boll worm (*Helicoperpa armigera* - Larva of insect). It is formed by transfer of pest resistant gene from *Bacillus thuringiensis* (bt-2 gene encoding Bt-toxin). *Bacillus thuringiensis* produces a toxic protein called crystal protein (Cry-Protein) this protein is toxic for larva of certain insect.

  This protein kills the insect by inhibiting ion transport in midgut (bt 2 gene is called cry-gene)
* In pollution control, microbes have been engineered to break up the crude oil spills.

  Dr. Ananda Mohan Chakraborthi introduced plasmid from different strains in to single cell of *Pseudomonas putida*. The result was new genetically engineered bacterium which would be used in cleaning oil spills called “Super bug” (oil eating bug.)

Applications of Recombinant DNA products

Medically useful recombinant products	Applications
Human insulin	Treatment of insulin - dependent diabetes
Human growth hormone	Replacement of missing hormone in short stature people.
Calcitonin	Treatment of rickets.
Chorionic gonadotropin	Treatment of infertility.
Blood clotting factor VIII/IX	Replacement of clotting factor missing in patients with Haemophilia A/B.
Tissue Plasminogen activator (TPA)	Dissolving of blood clots after heart attacks and strokes.
Erythropoietin	Stimulation of the formation of erythrocytes (RBCs) for

	patients suffering from anaemia during dialysis or side effects of AIDS patients treated by drugs.
Platelet derived growth factor	Stimulation of wound healing
Interferon	Treatment of pathogenic viral infections and cancer
Interleukin	Enhancement of action of immune system
Vaccines	Prevention of infectious diseases such as hepatitis B, herpes, influenza, pertusis, meningitis, etc.

Application of Genetically Engineered Microbes

Microbes	Applications
Escherichia coli (gut bacterium)	Production of human insulin, human growth factor interferons, interleukin and so on.
Bacillus thuringiensis (soil bacterium)	Production of endotoxin (Bt toxin), highly potent, safe and biodegradable insecticide for plant protection.
Rhizobium meliloti (bacterium)	Nitrogen fixation by incorporating "nif" gene in cereal crops.
Pseudomonas putida (bacterium)	Scavenging of oil spills, by digesting hydrocarbons of crude oil.
Bacterial strains capable of accumulating heavy metal	Bioremediation (cleaning of pollutants in the enviroment).
Trichoderma (fungus)	Production of enzyme chitinase for biocontrol of fungal diseases in plants.

Transgenics and their potential applications

Transgenic	Useful applications
Bt Cotton	Pest resistance, herbicide tolerance, and high yield.
Flavr Savr (Tomato)	Increased shelf-life (delayed ripening) and better nutrient quality
Golden Rice	Vitamin A and Fe - rich
Cattles (Cow, sheep, goat)	Therapeutic human proteins in their milk
Pig	Organ transplantation without risk of rejection

EXERCISE

1. Mass is the measure of
   (a) matter contained (b) weight
   (c) force (d) none of these
2. The mass is measured by
   (a) a beam balance (b) a spring balance
   (c) micro balance (d) none of these
3. A hydrometer is used to measure –
   (a) density (b) mass
   (c) weight (d) R.D.
4. Among the following the derived quantity is
   (a) mass (b) length
   (c) density (d) time
5. The SI unit of current is
   (a) kelvin (b) ampere
   (c) newton (d) volt
6. One micron equals to
   (a) 10^{-3} m (b) 10^{-9} m
   (c) 10^{-6} m (d) 10^{-2} m
7. The SI unit of density
   (a) gram/metre^3 (b) kilogram/metre^3
   (c) gram/cm^3 (d) kg/cm^3
8. Which of the following is not a fundamental unit?
   (a) newton (b) kilogram
   (c) metre (d) second
9. The unit of ..... is a derived unit –
   (a) temperature (b) length
   (c) velocity (d) luminous intensity
10. The SI unit of weight is :
    (a) kilogram (b) newton
    (c) newton metre (d) kilo metre
11. When a substance is heated its density
    (a) increases (b) decreases
    (c) remains same (d) none of these
12. In SI units, candela is the unit of
    (a) current (b) temperature
    (c) luminous intensity (d) none of the above
13. Practical unit of heat is
    (a) Calorie (b) Horse power
    (c) Joule (d) Watt
14. If force and displacement of particle in direction of force are doubled. Work would be –
    (a) Double (b) 4 times
    (c) Half (d) 1/4 times
15. If velocity of a body is twice of previous velocity, then kinetic energy will become –
    (a) 2 times (b) 1/2 times
    (c) 4 times (d) 1 times
16. The unit of work is
    (a) newton (b) joule
    (c) metre (d) second
17. 1 kilowatt hour is equal to –
    (a) 1 joule (b) 100 joule
    (c) 36 joule (d) 3.6×10^3 kilo joule
18. When a stone is thrown upward to a certain height, it possesses –
    (a) potential energy (b) kinetic energy
    (c) wind energy (d) sound energy
19. kilowatt hour is the unit of –
    (a) time (b) power
    (c) energy (d) force
20. A fast wind can turn the blades of a windmill because it possesses
    (a) potential energy (b) kinetic energy
    (c) chemical energy (d) heat energy
21. Splitting of Uranium nucleus releases
    (a) kinetic energy (b) potential energy
    (c) nuclear energy (d) chemical energy
22. A bullet fired from a gun possesses
    (a) potential energy (b) kinetic energy
    (c) wind energy (d) solar energy
23. Potential energy of your body is minimum when you –
    (a) are standing
    (b) are sitting on a chair
    (c) are sitting on the ground
    (d) lie down on the ground
24. Work is defined as
    (a) Force per unit time (b) Force over a distance
    (c) Force per unit distance (d) None of the above
25. The S.I. unit of energy is
    (a) joule (b) newton
    (c) metre/second (d) newton-metre
26. What is the sign of the work performed on an object in uniform circular motion?
    (a) Zero (b) Positive
    (c) Negative
    (d) Depends on the particular situation
27. What is the magnitude of the work done by a force acting on a particle instantaneously?
    (a) Zero (b) Positive
    (c) Negative (d) None of these
28. Energy is measured in the same units as
    (a) Power (b) Force
    (c) Work (d) None of the above
29. The units of power are defined as
    (a) Joules (b) Newtons
    (c) Joules per meter (d) Watts
30. The potential energy is always the same for an object with the same
    (a) Velocity (b) Speed
    (c) Acceleration (d) Position
31. The sum of potential and kinetic energy is always
    (a) Zero (b) Positive
    (c) Negative (d) None of the above

32. The sum of the change in kinetic and potential energy is always
(a) Zero (b) Positive
(c) Negative (d) None of the above

33. The potential energy of gravity is defined as
(a) mg (b) mg/h
(c) mgh (d) g/h

34. If the K.E. of a body is increased by 300%, its momentum will increase by –
(a) 100% (b) 150%
(c) $\sqrt{300}\%$ (d) 175%

35. Two masses m and 9m are moving with equal kinetic energies. The ratio of the magnitudes of their momenta is –
(a) 1 : 1 (b) 1 : 3
(c) 3 : 1 (d) 1 : 9

36. Kinetic energy is proportional to
(a) v^2 (b) v
(c) a (d) Work

37. When a gas is compressed, its pressure :
(a) increases (b) decreases
(c) remains the same (d) none of these

38. If the weight of a body is more than the weight of the liquid displaced by it, then the body may:
(a) float
(b) first floats and then sinks
(c) sinks
(d) neither floats nor sinks

39. The thrust is expressed in
(a) Newton (b) Pascals
(c) N/m^2 (d) none of these

40. When pressure exerted on an enclosed liquid or gas at rest, is transmitted equally in all the directions, is in accordance with:
(a) Pascal's law (b) Boyle's law
(c) Archimedes' principle (d) Principle of floatation

41. Purity of a metal can be determined with the help of
(a) Pascal's law
(b) Boyle's law
(c) Archimedes principle
(d) Conservation of mass principle

42. If both the mass and the velocity of a body is increased to twice of their magnitude, the kinetic energy will increase by
(a) 2 times (b) 4 times
(c) 8 times (d) 16 times

43. Two bodies kept at a certain distance feel a gravitational force F to each other. If the distance between them is made double the former distance, the force will be
(a) 2F (b) $\frac{1}{2}$F
(c) 4F (d) $\frac{1}{4}$F

44. Stationary wave is formed by
(a) a transverse wave superposing a longitudinal wave
(b) two waves of the same speed superposing
(c) two waves of same frequency travelling in the same direction
(d) two waves of same frequency travelling in the opposite direction

45. The force of attraction between the molecules is maximum:
(a) in sol ids (b) in liquids
(c) in gases
(d) in all the three states of matter

46. The liquid used in a simple barometer is :
(a) mercury (b) water
(c) alcohol (d) kerosene

47. Surface tension is due to –
(a) Frictional forces between molecules
(b) Cohesive forces between molecules
(c) Adhesive forces between molecules
(d) Gravitational forces

48. When there is no external force, the shape of a liquid drop is determined by –
(a) Surface tension of the liquid
(b) Density of liquid
(c) Viscosity of liquid
(d) Temperature of air body

49. A pin or a needle floats on the surface of water, the reason for this is –
(a) Surface tension (b) Less weight
(c) Upthrust of liquid (d) None of the above

50. The volume of the certain mass of a gas, at constant temperature is :
(a) directly proportional to pressure
(b) inversely proportional to pressure
(c) remains constant
(d) none of these

51. Atmospheric pressure is measured by
(a) thermometer (b) barometer
(c) speedometer (d) (b) and (c)

52. Surface tension of a liquid is due to force of molecules of the liquid
(a) cohesive (b) adhesive
(c) gravitational (d) frictional

53. The S.I. unit of heat energy is
(a) Joule (b) Calorie
(c) Kilo calorie (d) none of these

54. 1 calorie equals to
(a) 4.2 J (b) 0.42 J
(c) 420 J (d) 4200 J

55. Heat capacity equal to
(a) mass × specific heat capacity
(b) mass / specific heat capacity
(c) specific heat capacity / mass
(d) none of these

56. A and B are two bodies. The temperature of A is greater than that of B. The heat will flow
(a) A to B (b) B to A
(c) Will not flow (d) none of these

57. When water is heated from 0°C, its volume
(a) increases
(b) decreases till 4°C
(c) remains the same
(d) first increases then decreases

57. When salt is properly mixed with ice, the melting point of ice –
(a) is lowered (b) is raised
(c) remains the same (d) becomes infinite

59. Sound is produced when objects
(a) vibrate (b) accelerated
(c) displaced (d) frictionised

60. The sound travels fastest in
(a) solids (b) liquids
(c) gases (d) none of these

61. The unit to measure intensity of sound is
(a) decibel (b) joule
(c) candulla (d) none of these

62. Echo is a type of
(a) reflected sound (b) refracted sound
(c) polarised sound (d) none of these

63. Sound cannot travel though –
(a) solids (b) liquids
(c) gases (d) vacuum

64. One hertz is equivalent to –
(a) one cycle per second (b) one second
(c) one meter per second (d) one second per meter

65. The unit of frequency of sound is
(a) metre/second (b) metre/second
(c) hertz (d) none of these

66. Speed of sound at constant temperature depends on –
(a) Pressure (b) Density of gas
(c) both (a) & (b) (d) None of the above

67. The waves in which the particles of the medium vibrate in a direction perpendicular to the direction of wave motion is known as –
(a) Transverse wave (b) Longitudinal waves
(c) Propagated waves (d) None of these

68. Ultrasonic waves have frequency –
(a) below 20 Hz
(b) between 20 and 20,000 Hz
(c) only above 20,000 Hz
(d) only above 20,000 MHz

69. To hear a distinct echo, the minimum distance of a reflecting surface should be :
(a) 17 metres (b) 34 metres
(c) 68 metres (d) 340 metres

70. In a long spring which of the following type of waves can be generated –
(a) Longitudinal only
(b) Transverse only
(c) Both longitudinal and transverse
(d) Electromagnetic only

71. The unit of quantity on which loudness of sound depends is –
(a) metre (b) Hz
(c) metre/second (d) second

72. Light is a form of
(a) energy (b) work
(c) power (d) none of these

73. The white light consists of
(a) no colours (b) seven colours
(c) three colours (d) None of these

74. Light travels in a
(a) straight line
(b) curved lines
(c) neither straight nor curved
(d) none of these

75. In a plane mirror the distance of an image is the
(a) same as that of the object
(b) greater as that of the object
(c) less as that of the object
(d) none of these

76. A real, inverted and highly diminished image is formed by a convex lens when the object is placed at
(a) the focus (b) infinity
(c) 2F (d) none of these

77. A spherical mirror whose inner hollow surface is the reflecting surface is a :
(a) convex mirror (b) concave mirror
(c) plane convex (d) plane concave

78. The lens used in spectacles for the correction of short-sightedness is a
(a) concave lens (b) convex lens
(c) piano-convex lens (d) none of these

79. When light splits by a glass prism into seven colours, the phenomenon is called
(a) reflection of light (b) refraction of light
(c) dispersion of light (d) spectrum

80. The type of lens present in human eye is
(a) convex lens (b) concave lens
(c) piano-lens convex (d) piano-lens concave

81. The image formed in a plane mirror is :
(a) real (b) virtual
(c) larger (d) none of these

82. The type of lens used as a magnifying glass
(a) concave lens (b) convex lens
(c) concavo-convex lens (d) convexo-concave lens

83. Which one of the following materials cannot be used to make a lens?
(a) Water (b) Glass
(c) Plastic (d) Clay

84. The focal length of a concave mirror depends upon –
(a) The radius of curvature of the mirror
(b) The object distance from the mirror
(c) The image distance from the mirror
(d) Both image and object distance

85. The radius of curvature of a plane mirror is -
(a) zero (b) infinite
(c) negative (d) finite

86. Tick out the only wrong statements in the following –
(a) Light travels with a speed greater than that of sound
(b) Light cannot travel through vacuum
(c) Light travels in a straight line
(d) Light has no weight

87. If a real object is placed inside the focal point of a concave mirror, the image is –
(a) real and upright (b) real and inverted
(c) virtual and upright (d) virtual and inverted

88. A person standing infront of a mirror finds his image smaller than himself and erect. This implies the mirror is –
(a) plane (b) concave
(c) convex (d) None of the above

89. A solar eclipse is caused when the
(a) sun comes between the earth and the moon
(b) moon comes between the sun and the earth
(c) earth comes between the sun and the moon
(d) none of these

90. A ray from air enters water, then through a thick layer of glass placed below water. After passing through glass, it again comes out in air medium. Then final emergent ray will–
(a) Bend towards the normal
(b) Bend away from the normal
(c) Suffer lateral displacement
(d) Have the same path as if it had not passed through glass and water.

91. A lens produces a enlarged, virtual image. What kind of lens is it?
(a) converging
(b) diverging
(c) It could be either diverging or converging.
(d) None

92. Virtual images of object of the same size are formed by –
(a) a concave mirror (b) a convex mirror
(c) a plane mirror (d) all the above

93. The splitting of white light into several colours on passing through a glass prism is due to –
(a) refraction (b) reflection
(c) interference (d) diffraction

94. Rainbow is formed due to a combination of –
(a) Refraction and absorption
(b) Dispersion and focussing
(c) Refraction and scattering
(d) Dispersion and total internal reflection

95. If angle of incidence is 60°, then the angle of reflection will be
(a) 30° (b) 60°
(c) 120° (d) 90°

96. Myopia is due to –
(a) elongation of eye ball
(b) irregular change in focal length
(c) shortening of eye ball
(d) older age

97. Blue colour of sky is due to phenomenon of –
(a) Reflection (b) Refraction
(c) Scattering (d) Dispersion

98. The human eye can focus objects at different distances by adjusting the focal length of the eye lens. This is due to
(a) presbyopia (b) accommodation
(c) near-sightedness (d) far-sightedness

99. The change in focal length of an eye lens is caused by the action of the –
(a) pupil (b) retina
(c) ciliary muscles (d) iris

100. Rainbow is caused due to –
(a) Reflection of sun light air
(b) Dispersion of sun light from water drops
(c) Refraction of sun light from water drops
(d) Diffraction of sun rays from water drops

101. In the visible spectrum the colour having the shortest wavelength is –
(a) Green (b) Red
(c) Violet (d) Blue

102. On entering a glass prism, sun rays are –
(a) Deviated but not dispersed
(b) Deviated and dispersed
(c) Dispersed but not deviated
(d) Neither deviated nor dispersed.

103. In case of hypermetropia –
(a) The image of near objects is formed in front of retina
(b) The image of near objects is formed behind the retina
(c) A concave lens should be used for correction
(d) A convex lens cannot be used for correction

104. Astigmatism can be corrected by –
(a) Bifocal lenses (b) Cylindrical lenses
(c) Concave lenses (d) Planoconvex lenses

105. The phenomenon of light in which light that strikes to smooth surface and thrown back into the same medium is called
(a) reflection (b) refraction
(c) scattering (d) none of these

106. A man wearing glasses of focal length +1m cannot clearly see beyond one meter –
(a) If he is far sighted (b) If he is near sighted
(c) If his vision is normal (d) In each of these cases

107. The image formed by convex lens in a simple microscope
(a) virtual and erect
(b) real and inverted
(c) equal in size with the object
(d) none of these

108. The mirror used in motor vehicles near the driver's seat is a
(a) concave mirror (b) convex mirror
(c) plane mirror (d) none of these

109. Light waves –
(a) Require air or another gas to travel through
(b) Require an electric field to travel through
(c) Require a magnetic field to travel through
(d) Can travel through perfect vacuum

110. The image formed by a convex spherical mirror is –
(a) sometimes real, sometimes virtual
(b) sometimes erect, sometimes inverted
(c) always real and inverted
(d) always virtual and upright.

111. The term refraction of light is –
(a) The bending of light rays when they enter from one medium to another medium
(b) Splitting of white light into seven colours when it passes through the prism
(c) Bending of light round corners of obstacles and apertures
(d) Coming back of light from a bright smooth surface

112. The absolute refractive index of a medium depends on –
(a) nature of the medium only
(b) wavelength of light only
(c) temperature of the medium only
(d) all of the above

113. A real image is formed by a convex mirror when the object is placed at –
(a) infinite
(b) between center of curvature and focus
(c) between focus and pole
(d) none of the above

114. Ability of the eye to see objects at all distances is called –
(a) Binocular vision (b) Myopia
(c) Hypermetropia (d) Accommodation

115. The point where the rays from a point object meet after reflection through a lens is called the
(a) focus (b) centre of curvature
(c) optical centre (d) image point

116. In the figure in previous question, the white screen is at the–
(a) centre of curvature of the concave mirror
(b) principal focus of the concave mirror
(c) pole of the concave mirror
(d) none of above

117. The length of a wire is doubled and the radius is doubled. By what factor does the resistance change–
(a) 4 times as large (b) twice as large
(c) unchanged (d) half as large

118. Kilowatt-hour is the unit of –
(a) potential difference (b) electric power
(c) electrical energy (d) charge

119. An electric bulb is filled with –
(a) hydrogen (b) oxygen and hydrogen
(c) ammonia (d) nitrogen and argon

120. The unit of resistivity is –
(a) ohm (b) ohm/m
(c) ohm × m (d) mho

121. If a wire is stretched to make its length three times, its resistance will become –
(a) three times (b) one-third
(c) nine times (d) one-ninth

122. The resistivity of a wire depends on –
(a) length
(b) area of cross-section
(c) material
(d) all the above three factors

123. Which of the following statements does not represent Ohm's law
(a) current/potential difference = constant
(b) potential difference/current = constant
(c) potential difference =current × resistance
(d) current = resistance × potential difference

124. Fleming's right hand rule is used to find the direction of the
(a) Alternate current (b) Direct current
(c) Induced current (d) Actual current

125. The unit of electrical power is
(a) Volt (b) Watt
(c) Kilowatt hour (d) Ampere

126. The resistance of the human body (dry condition) is of the order of
(a) 10^1 Ohm (b) 10^2 Ohm
(c) 10^3 Ohm (d) 10^4 Ohm

127. Certain substances loose their electrical resistance completely at super low temperature. Such substances are called
(a) super conductors (b) semi conductors
(c) dielectrics (d) perfect conductors

128. Fuse wire is made of –
(a) platinum (b) copper
(c) aluminium (d) alloy in tin and lead

129. Which of the following terms does not represent electrical power in a circuit?
(a) I^2R (b) IR^2
(c) VI (d) V^2/R

130. Ampere-second stands for the unit of –
(a) power (b) charge
(c) emf (d) energy

131. Coulomb is equal to –
(a) 1 amp × 1 sec (b) 1 amp/1 sec
(c) 1 joule × 1 amp (d) 1 joule/1 sec

132. The unit for specific resistance is –
(a) ohm × second (b) ohm × cm
(c) ohm (d) ohm/cm

133. The unit for electric conductivity is –
(a) ohm per cm (b) ohm × cm
(c) ohm per second (d) mho

134. The filament of an electric bulb is of tungsten because –
(a) Its resistance is negligible
(b) It is cheaper
(c) Its melting point is high
(d) Filament is easily made

135. The resistance of a thin wire in comparison of a thick wire of the same material –
(a) is low (b) is equal
(c) depends upon the metal of the wire
(d) is high

136. The resistance of an ideal voltmeter is –
(a) zero (b) very low
(c) very large (d) Infinite

137. The reciprocal of resistance is –
(a) Conductance (b) Resistivity
(c) Voltage (d) None of the above

138. When same charged bodies are brought nearer, these will show
(a) attraction (b) repulsion
(c) no effect (d) none of these

139. The flow of electrons (electric charge) is known as
(a) electric current (b) electric potential
(c) electric field (d) none of these

140. Electric current is measured by a device called
(a) voltmeter (b) ammeter
(c) electroscope (d) none of these

141. When an electric current flows through a conductor, it produces heat. This effect is called
(a) heating effect of current (b) magnetic effect
(c) chemical effect (d) none of these

142. Which has no importance for fuse wire –
(a) Specific resistance of wire
(b) Diameter of wire
(c) Length of wire
(d) Current passing through the wire

143. The specific resistance of a wire varies with its –
(a) Length (b) Cross-section
(c) Mass (d) Material

144. The unit of specific resistance is –
(a) ohm (b) ohm^{-1}
(c) ohm-metre (d) ohm per metre

145. How many electrons constitute a current of one microampere –
(a) 6.25×10^6 (b) 6.25×10^{12}
(c) 6.25×10^9 (d) 6.25×10^{15}

146. Good conductors have many loosely bound –
(a) atoms (b) protons
(c) molecules (d) electrons

147. The variable resistance is called –
(a) resistor (b) rheostat
(c) open switch (d) none of these

148. If the length of a wire is doubled and its cross-section is also doubled, then the resistance will –
(a) increase eight times (b) decrease four times
(c) become four times (d) remain unchanged

149. Instruments can be shielded from outside magnetic effects by surrounding them with
(a) Iron shield (b) Rubber shield
(c) Brass shield (d) Glass shield

150. The following is a pseudo-force:
(a) Centrepetal force
(b) Centrifugal reaction force
(c) Centrifugal force
(d) Strong nuclear force

151. The hydraulic brake used in automobiles is a direct application of
(a) Archimedes' principle (b) Torricellean law
(c) Bernoulli's Theorem (d) Pascal's law

152. Supersonic air planes create a shock wave called
(a) Transition wave (b) Ultrasound
(c) Transverse wave (d) Sonic boom

153. The danger signals are red while the eye is more sensitive to yellow because
(a) absorption in red is less than yellow and hence red is visible from a distance
(b) scattering in yellow light is less than red
(c) the wavelength of red light is more than yellow light
(d) none of the above reasons

154. Gases are good conductors of electricity at –
(a) high pressure (b) low pressure
(c) low temperature (d) high temperature

155. Which one of the following atmospheric layers absorb ultraviolet rays of the sun?
(a) Troposphere (b) Stratosphere
(c) Ionosphere (d) Ozonosphere

156. In nuclear reactions, there is conservation of
(a) mass only
(b) momentum only
(c) energy only
(d) mass, energy and momentum

157. Photoelectric effect is
(a) an instantaneous process
(b) delayed process
(c) emission of protons
(d) emission of neutrons

158. For a particle moving with a constant speed along a straight line PQ, the hodograph is
(a) a straight line parallel to PQ
(b) a straight line perpendicular to PQ
(c) a point
(d) a circle

159. The insulator from the following is
(a) mercury (b) glass
(c) copper (d) silver

160. The commonly used safety fuse wire is made of –
(a) copper (b) lead
(c) nickel (d) an alloy of tin and lead

161. Plastics
(a) are light.
(b) can be spun into fibres to make cloth and carpets.
(c) can be coloured and moulded into any desired shape.
(d) (a), (b) and (c).

162. Synthetic fibres are also
(a) polymers (b) macromolecules
(c) monomers (d) None of these

163. Which of the following is thermosetting plastics?
(a) Polyvinyl chloride (b) Polyester
(c) Polypropylene (d) Bakelite

164. Polycot is obtained by mixing
(a) polyester and cotton (b) polyester and wool
(c) cotton and wool (d) None of these

165. Which of the following is the maximum number of electrons that can be present in M-shell?
(a) 2 (b) 8
(c) 18 (d) 32

166. In an oxygen molecule, two atoms are united by
(a) the bond (b) two bonds
(c) three bonds (d) four bonds

167. The inert gas which is substituted for nitrogen in the air used by deep sea divers for breathing is
(a) Neon (b) Krypton
(c) Argon (d) Helium

168. How many neutrons are there in $_{92}U^{238}$ atom ?
(a) 92 (b) 238
(c) 146 (d) 330

169. Polyvinylchloride on burning give fumes of
(a) HCl (b) Cl_2
(c) H_2 (d) None of these

170. Which of the following is the best conductor of electricity:
(a) Gold (b) Silver
(c) Copper (d) Iron

171. Find the odd one.
(a) Marble (b) Chalk
(c) Limestone (d) Slaked lime

172. Amides can be converted to amines by the reaction named
(a) Perkin (b) Claisen
(c) Hoffman (d) Clemmesen

173. The base used as an antacid is
(a) Calcium hydroxide (b) Barium hydroxide
(c) Magnesium hydroxide (d) Silver hydroxide

174. A process which is not helpful in the prevention of rusting of iron is
(a) annealing (b) applying grease
(c) galvanising (d) painting

175. Denatured alcohol
(a) is a form of alcohol
(b) is unfit for drinking as it contains poisonous substances
(c) contains coloured impurities
(d) is sweet to taste

176. Phenolics as pollutants can be removed from waste water by use of
(a) Ion exchange resin technique
(b) Electrolyte decomposition technique
(c) Reverse osmosis method
(d) Polymeric adsorbents

177. Metal reacts with oxygen to form
(a) neutral oxides. (b) basic oxides.
(c) acidic oxides. (d) None of these

178. The metal used to built bridges is
(a) gold. (b) silver.
(c) platinum. (d) iron.

179. Non-metallic oxide are
(a) acidic. (b) basic.
(c) neutral. (d) (a) and (c).

180. Rusting of iron can be prevented by
(a) alloying. (b) painting.
(c) galvanising. (d) All of these.

181. Which of the following is a good conductors of heat and electricity?
(a) Graphite (b) Oxygen
(c) Chlorine (d) Nitrogen

182. Metals are
(a) malleable. (b) ductile.
(c) None. (d) Both.

183. Metals can be obtained economically from
(a) minerals. (b) ores.
(c) earth's crust (d) none.

184. Which of the following have low melting and boiling points:
(a) Phosphorus (b) Sodium
(c) Iron (d) (a) and (b)

185. Brass contains
(a) Copper and Zinc (b) Copper and Tin
(c) Copper and Silver (d) Copper and Nickel

186. Which is the purest commercial form of iron?
(a) Pig iron (b) Steel
(c) Stainless steel (d) Wrought iron

187. In galvanization, iron is coated with
(a) Copper (b) Zinc
(c) Tin (d) Nicked

188. Which one of the following is also known as solution?
(a) A compound
(b) A homogeneous mixture
(c) A heterogeneous mixture
(d) A suspension

189. Which of the following metals burn with a white dazzing light, with oxygen?
(a) Sodium (b) Potassium
(c) Magnesium (d) Aluminium

190. H_2O (water) is
(a) an acidic oxide. (b) a basic oxide.
(c) a neutral oxide. (d) an amphoteric oxide.

191. Reduction of nitrates to ammonia can be achieved through one of the following methods :
(a) in alkaline medium using Devarda's alloy.
(b) in neutral medium using Devarda's alloy.
(c) in acidic medium using Devarda's alloy.
(d) in neutral medium using Cupric oxide.

192. The most affected sulphur containing amino acid by PAN is
(a) Cysteine (b) Methonine
(c) Proline (d) Globuline

193. Which of the following has zero electron affinity ?
(a) Oxygen (b) Fluorine
(c) Nitrogen (d) Neon

194. How do most insects respire ?
(a) Through skin (b) Through gills
(c) By tracheal system (d) By lungs

195. When a particle and an antiparticle come in contact with each other, they
(a) repell each other
(b) annihilate each other
(c) go undisturbed
(d) spin about a common axis

196. Aluminium is obtained by the electrolysis of pure Al_2O_3 dissolved in
(a) Bauxite (b) Cryolite
(c) Feldspar (d) Alumina

197. Complete hydrolysis of cellulose gives
(a) D-fructose (b) L-glucose
(c) D-glucose (d) L-fructose

198. Zinc is
(a) non-malleable. (b) brittle.
(c) ductile. (d) (a) and (b).

199. The only non-metal that has luster is
(a) Sulphur (b) Phosphorus
(c) Silicon (d) Iodine

200. Which of the following is a liquid metal?
(a) Mercury (b) Bromine
(c) Water (d) Sodium

201. The property of metals to be hammered into their sheets is called
(a) malleability (b) ductility
(c) tensile strength (d) sonorous nature

202. Select the metal that is soft
(a) Aluminium (b) Copper
(c) Sodium (d) Lead

203. The process of protecting iron, from rusting, by coating with zinc is called
(a) Rusting (b) Roasting
(c) Smelting (d) Galvanizing

204. Graphite is a/an –
(a) alloy (b) metal
(c) metalloid (d) non metal

205. The white phosphorus is stored –
(a) in air (b) under water
(c) under kerosene (d) under CS_2

206. The chief ore of aluminium is –
(a) bauxite (b) cryolite
(c) alunite (d) feldspar

207. Which is the best variety of coal?
(a) Peat (b) Lignite
(c) Anthracite (d) Bituminous

208. Which is a fossil fuel?
(a) Natural gas (b) Biogas
(c) Producer gas (d) None of these

209. Which of the following cells do not have a nucleus ?
(a) Brain cell (b) Cardiac muscle fibres
(c) Paraecium (d) Mature human RBC

210. Which cell organelle is known as the control centre of the cell ?
(a) Nucleus (b) Chloroplast
(c) Mitochondria (d) Endoplasmic reticulum

211. Energy currency of the cell is –
(a) AMP (b) GTP
(c) ATP (d) All

212. Which of the following organelles are semiautonomous organelle ?
(a) Mitochondria (b) Ribosomes
(c) Chloroplast (d) Both (a) and (c)

213. In the mitochondrion energy is stored in the form of
(a) adenosine triphosphate (ATP)
(b) adenosine monophosphate (AMP)
(c) citric acid
(d) adenosine diphosphate (ADP)

214. The site of protein synthesis in plants is the
(a) Chloroplast (b) Ribosomes
(c) Pyrenoids (d) Mitochondria

215. Synthesis of any protein in a cell is determined by
(a) type of ribosomes
(b) mitochondria
(c) sequence of nucleotides in DNA
(d) sugar and phosphate of DNA

216. The plasma membrane is
(a) permeable (b) semipermeable
(c) differentially permeable (d) impermeable

217. A form of condensation that reduces visibility and causes breathing problems is
(a) Dew (b) Frost
(c) Smog (d) Mist

218. The total population divided by available arable land area is referred to as
(a) Population density (b) Nutritional density
(c) Agricultural density (d) Industrial density

219. Green glands are associated with
(a) Reproduction (b) Excretion
(c) Respiration (d) Digestion

220. During respiration, the gases enter into the blood and leave the same by the process of
(a) Active transport
(b) Diffusion
(c) Diffusion and active transport
(d) Osmosis

221. Heart is devoid of
(a) Cardiac muscle (b) Involuntary muscle
(c) Voluntary muscle (d) Smooth muscle

222. The soil salinity is measured by
(a) Conductivity meter (b) Hygrometer
(c) Psychrometer (d) Auxanometer

223. Which of the following is a fungal disease?
(a) Leucoderma (b) Eczema
(c) Ringworm (d) Elephantiasis

224. Chickenpox is caused by
(a) DNA virus (b) Variola virus
(c) Streptococcus (d) Vibrio cholerae

225. The stability of a pond ecosystem depends on
(a) micro-organisms and fishes
(b) micro-organisms and zoo planktons
(c) fishes and reptiles
(d) producers and consumers

226. The main factor which determines the balance of nature is
(a) human activities (b) Rabit and habitat
(c) environmental conditions (d) availability of food

227. The golgi bodies are related to
(a) Respiration (b) Excretion
(c) Secretion (d) Circulation

228. The most abundant compound in cytoplasm is
(a) fat (b) water
(c) protein (d) carbohydrates

229. Mitochondria usually occur in
(a) Vegetative cells
(b) Reproductive cells
(c) Both vegetative and reproductive cells
(d) None of these

230. Which of the following is not a renewable resource?
(a) Thorium (b) Geothermal heat
(c) Tidal power (d) Radiant energy

231. Which one of the following pairs is not correctly matched?
(a) Hevea Tree—Brazil
(b) Sumatra Storm—Malaysia
(c) Kajan River—Borneo
(d) Dekke Toba fish—Brazil

232. Which of the following resources is renewable one?
(a) Uranium (b) Coal
(c) Timber (d) Natural Gas

233. How many neck canal cells are found in the archegonium of a fern?
(a) One (b) Two
(c) Three (d) Four

234. Which angiosperm is vesselless?
(a) Hydrilla (b) Trochodendron
(c) Maize (d) Wheat

235. Myrmecology is study of
(a) Insects (b) Ants
(c) Crustaceans (d) Arthropods

236. HIV often changes is shapes due to the presence of an enzyme called
(a) Reverse Transcriptase (b) Enterokinase
(c) Nucleotidase (d) Nucleoditase

237. The cells which are closely associated and interacting with guard cells are
(a) Transfusion tissue (b) Complementary cells
(c) Subsidiary cells (d) Hypodermal cells

238. Conversion of starch to sugar is essential for
(a) Stomatal opening (b) Stomatal closing
(c) Stomatal formation (d) Stomatal growth

239. Soil erosion can be prevented by
(a) Increasing bird population
(b) Afforestation
(c) Removal of vegetation
(d) Overgrazing

240. Natural sources of air pollution are
(a) Forest fires
(b) Volcanic eruptions
(c) Dust storm
(d) Smoke from burning dry leaves

241. Which of the following Genetically Modified vegetable is recently being made available in Indian market?
(a) Carrot (b) Radish
(c) Brinjal (d) Potato

242. The smallest organelle in the cell is
(a) Lysosome (b) Ribosome
(c) Mitochondria (d) Peroxisome

243. Cyanobacteria have-
(a) A well-defined nucleus and chloroplast.
(b) A well-defined nucleus but no chloroplast.
(c) Incipient nucleus and vesicles containing chlorophyll.
(d) Incipient nucleus but no chloroplast or pigment.

244. Which of the following cellular components can be used to distinguish a prokaryotic cell from a eukaryotic cell?
(a) Nucleus (b) Plasma membrane
(c) DNA (d) Proteins

245. Active transport through the plasma membrane occurs through the action of
(a) diffusion (b) membrane proteins
(c) DNA (d) water

246. The drainage pattern developed on folded sedimentary rock is termed as
(a) Trellis (b) Dendritic
(c) Radial (d) Deranged

247. Water potential remains lowest in
(a) Water plants (b) Woody plants
(c) Succulents (d) Halophytes

248. The free living bacterium in the soil which increases the the yield of rice is
(a) Rhizobium (b) Azotobacter
(c) Acetobacter (d) Anabaena

249. The human body's largest blood vessel is
(a) Pulmonary artery (b) Aorta
(c) Renal artery (d) Coronary artery

250. In human body, which one of the following hormones regulates blood calcium and phosphate ?
(a) Glucagon (b) Growth hormone
(c) Parathyroid hormone (d) Thyroxine

251. Frontal cyclones occur characteristically in
(a) Equatorial region (b) Tropical region
(c) Mid-latitudinal region (d) Polar region

252. Each body segment of Earthworm is called
(a) Proglottid (b) Metamere
(c) Scolex (d) Rostellum

253. The outermost boundary of an animal cell is the
(a) plasma membrane (b) nucleus
(c) cytoplasm (d) cytoskeleton

254. The energy necessary for active transport across cytoplasmic membranes is believed to come from
(a) ATP (b) Diffusion
(c) Osmosis (d) Kinetic energy

255. The cell membrane is composed primarily of
(a) Cellulose (b) Chitin
(c) Lipids (d) Lipids and proteins

256. The cell's "garbage disposals" are the
(a) lysosomes (b) peroxisomes
(a) mitochondria (d) vacuoles

257. What part of the cell is responsible for breaking down and digesting things ?
(a) Ribosomes (b) Lysosomes
(c) Endoplasmic reticulum (d) Vacuole

258. What part of the cell serves as the intracellular highway?
(a) Endoplasmic reticulum (b) Golgi apparatus
(c) Cell membrane (d) Mitochondria

259. Which of the following would you not find in a bacterial cell ?
(a) DNA (b) Cell membrane
(c) Golgi apparatus (d) Ribosomes

260. The pancreas secretes
(a) Insulin (b) Bile juice
(c) Peptic juice (d) None of these

261. When we touch leaves of "Touch me not plant", they close, these movements are called
(a) photonastic movements
(b) nyctinastic movements
(c) seismonastic movements
(d) chemonastic movements

262. The concept of tissue culture was introduced by
(a) Halfmeister (b) Hanstein
(c) Haberlandt (d) Hanning

263. Beak is formed by
(a) cheeks (b) jaws
(c) teeth (d) none

264. Pinna (external ear) is present in
(a) Amphibian (b) Fish
(c) Mammal (d) Reptile

265. Which of the following could be found in both the nucleus and the cytoplasm?
(a) Nucleolus (b) Ribosomes
(c) RNA (d) Both RNA & ribosomes

266. The exchange of gases (O_2 and CO_2) in a mammal takes place in –
(a) Trachea (b) Brochin
(c) Bronchiole (d) Alveoli

267. In anaerobic respiration –
(a) Oxygen is taken in
(b) Carbon dioxide is taken in
(c) Oxygen is given out
(d) Carbon dioxide is given out

268. Human red blood cells transport –
(a) oxygen (b) dissolved food
(c) hormones (d) antibodies

269. The plasma is composed mainly of which chemical ?
(a) Alcohol (b) Water
(c) Sodium chloride (d) Hormones

270. In humans, gas exchange and gas transport occur as a result of the functioning of a system of
(a) setae (b) ganglia
(c) phloem tubes (d) lungs and blood vessels

271. The exchange of gases in the alveoli of the lungs take place by
(a) osmosis (b) simple diffusion
(c) passive transport (d) active transport

272. A pacemaker is meant for
(a) transporting liver (b) transplanting heart
(c) initiation of heart beats (d) regulation of blood flow

273. Normal blood pressure (systolic/diastolic) is
(a) 120/80 mm of Hg (b) 160/80 mm of Hg
(c) 120/60 mm of Hg (d) 180/80 mm of Hg

274. We think lichens are cool because –
(a) They are delicate and die in very cold climates.
(b) They are a combination of cyanobacteria and fungi.
(c) They are parasitic.
(d) None of the Above

275. Which is a member of the fungi kingdom?
(a) Mushroom (b) Yeast
(c) Water Mold (d) All of these

276. A bacteria flagellum is –
(a) A series of tubes inside the cell.
(b) A tail-like structure for movement.
(c) A long carbohydrate for connections.
(d) None of these

277. You will never find a ..... in a bacteria.
(a) Cell Wall (b) Cell Membrane
(c) Cell Nucleus (d) None of the above

278. Which of these is a fungus?
(a) Mould (b) Mushroom
(c) Truffle (d) All of the above

279. Mushrooms are
(a) Basidiomycetes (b) Ascomycetes
(c) Zygomycetes (d) None of these

280. The colour of lichen usually comes from the –
(a) Fungus (b) Algae
(c) Cyanobacteria (d) None of the above

281. One phrase that could describe the organisms in lichens is
(a) Mutually exclusive (b) Parasitic
(c) Mutually beneficial (d) None of the above

282. Which of these diseases is not caused by a virus?
(a) AIDS (b) Measles
(c) Flesh eating bacteria (d) Rabies

283. The structural material of bacterial wall is –
(a) Cellulose (b) Peptidoglycan
(c) Protein (d) Fungus cellulose

284. In blue green algae, the structure specialised for nitrogen fixation is –
(a) Thylakoid (b) Harmogonia
(c) Heterocyst (d) Endospore

285. The most ancient group of ogranisms of the earth is –
(a) Eubacteria (b) Cyanobacteria
(c) Archaebacteria (d) PPLO

286. The extra nuclear DNA in a bacterial cell contains genes for –
(a) Sexuality
(b) Drug resistance
(c) Mortality
(d) Sexuality and drug resistance

287. Bacterial photosynthesis does not utilize –
(a) Water (b) CO_2
(c) H_2S (d) Thiosulphate

288. Non-symbiotic nitrogen fixers are –
(a) *Azatobacter* (b) Blue green algae
(c) Soil fungi (d) *Pseudomonas*

289. Mycoplasma differ from bacteria in –
(a) Not having a cell wall
(b) Having organised nucleus
(c) Having organised cell organelles
(d) None of the above

290. Yeast differs from bacteria in being
(a) Multicellular (b) Prokaryotic
(c) Eukaryotic (d) Unicellular

291. Pseudomycelium is formed in –
(a) Yeast (b) *Rhizopus*
(c) Mushroom (d) *Puccinia*

292. The fungal partner of lichens is known as –
(a) Mycobiont (b) Phycobiont
(c) Symbiont (d) Basidiomycetes

293. What are 'Fungi Imperfecti' ?
(a) They are fungi that reproduce only sexually.
(b) They are the fungi that reproduce exclusively by vegetatives and asexual methods.
(c) They are the fungi which only show parasitic mode of nutrition.
(d) None of the above.

294. Who invented vaccine for small pox ?
(a) Robert Koch (b) Robert Hooke
(c) Edward Jener (d) Louis Pasteur

295. Which of the following is a viral disease ?
(a) Tetanus (b) Tuberculosis
(c) Typhoid (d) AIDS

296. BCG stands for –
(a) Bacillus Carol Gram
(b) Bacillus Chalmette Guerin
(c) Bacteria Chalmette Gram
(d) None of the above

297. Which of the following diseases is also known as infantile paralysis?
(a) Lock jaw (b) Rabies
(c) Polio (d) Chicken pox

298. Which of the following is not a communicable disease ?
(a) Typhoid (b) Malaria
(c) AIDS (d) Goitre

299. Against which of the following does *interferon* act ?
(a) Bacteria (b) Virus
(c) Fungi (d) Snake venom

300. Which of the following disease is a hormonal disorder ?
(a) Anaemia (b) Cholera
(c) Diabetes (d) Goitre

301. AIDS is caused by –
(a) Blood cancer (b) HTLV-III
(c) Bacterium (d) TMV

302. Vaccines are prepared from immune –
(a) Vitamins (b) Blood
(c) Serum (d) Plasma

303. AIDS is a/an
(a) Endemic disease (b) Epidermic disease
(c) Sporadic disease (d) Pandemic disease

304. Which one of the following pairs of disease can spread through blood transfusion?
(a) Cholera and hepatitis
(b) Hepatitis and AIDS
(c) Diabetes mellitus and malaria
(d) Hay fever and AIDS

305. Which of the following diseases is caused by Protozoa ?
(a) Chicken pox (b) Measles
(c) Filariasis (d) Sleeping sickness

306. The term "antibiotic" was coined by –
(a) Alexander fleming (b) Edward Jenner
(c) Louis Pasteur (d) Selman waksman

307. Antibodies are produced by –
(a) Erythrocytes (b) Thrombocytes
(c) Monocytes (d) Lymphocytes

308. B.C.G. vaccine is used against –
(a) T.B. (b) Leprosy
(c) Food poisoning (d) None of these

309. DPT vaccine is given for –
(a) Tetanus, polio, plague
(b) Diptheria, whooping cough and leprosy
(c) Diptheria, pneumonia, tetanus
(d) Diptheria, whooping cough, tetanus

310. Active immunity is obtained by –
(a) Antibodies
(b) Weakened germs infection
(c) Natural resistance
(d) None of these

311. Which is an autoimmune disease?
(a) Cancer
(b) Asthma
(c) *Erythroblastosis foetalis*
(d) *Rheumatoid arthritis*

312. 'Polio' is caused by –
(a) A bacteriophage
(b) A virus with single strand RNA
(c) A virus with single strand DNA
(d) A virus with double strand DNA

313. If the body rejects its own cells, it is called –
(a) Autografting (b) Hormonal deficiency
(c) Immuno deficiency (d) Auto immunity

314. The jaundice is a physiological liver disease. It is caused by a –
(a) Bacterium (b) Virus
(c) Protozoan (d) Helminth

315. Which of the disease is not transmitted by house flies?
(a) Typhoid (b) Yellow fever
(c) Cholera (d) Dysentery

316. Cholera is caused by –
(a) Virus (b) Bacteria
(c) Fungi (d) Protozoan

317. The malignant tertian malaria is caused by –
(a) *Plasmodium vivax* (b) *Plasmodium falciparum*
(c) *Plasmodium ovale* (d) *Plasmodium malariea*

318. All the diseases are spread by housefly except –
(a) Leprosy (b) Dysentery
(c) Typhoid (d) Sleeping sickness

319. Tobacco smoke contains carbon monoxide which –
(a) Reduces the oxygen-carrying capacity of blood
(b) Causes gastric ulcers
(c) Raises blood pressure
(d) Is carcinogenic

320. Group of viral borned disease is –
(a) Hepatities and typhoid (b) Polio and dengue
(c) Rabies and tetanus (d) Measles and cholera

321. Mosquito is not a vector for a disease from following–
(a) Malaria (b) Typhoid
(c) Dengu (d) Elephantitis

322. The impaction human health is due to change in environment, which is caused by human interference, is –
(a) fatal (b) good
(c) very good (d) general

323. Passive immunity was discovered by –
(a) Robert Koch (b) L. Pasteur
(c) Edward Jenner (d) Eemil Von Behring

324. Health is –
(a) Complete physical well being
(b) Mental well being
(c) Social well being
(d) All the above

325. Community health aims at –
(a) Better health and family planning
(b) Better hygiene and clean environment
(c) Removing communicable diseases
(d) All of the above

326. 'Pathogens' were discovered by –
(a) Edward Jenner (b) William Harvey
(c) Pasteur (d) Robert Koch

327. Immune deficiency syndrome in human could develop as a consequence of –
(a) AIDS virus infection (b) Defective liver
(c) Defective thymus (d) Weak immune system

328. A scientist associated with 'antibiotic' is –
(a) Brown (b) Flemming
(c) Leeuwenhoek (d) Koch

329. An antibody is –
(a) Molecule that specifically inactivates an antigen
(b) WBC which invades bacteria
(c) Secretion of mammalian RBC
(d) Component of blood

330. Full form of AIDS is
(a) Anti immune deficiency syndrome
(b) Auto immune deficiency syndrome
(c) Acquired immune deficiency syndrome
(d) Acquired immune disease syndrome

331. The AIDS test is known as –
(a) ELISA (b) Australian antigen
(c) HIV test (d) None of these

332. Which of the following is a communicable disease?
(a) Phenylketoneuria (b) Cancer
(c) Rabies (d) Alkaptonuria

333. The biological agents of disease include –
(a) Minerals, vitamins, proteins and carbohydrates
(b) Viruses,bacteria, fungi, helminths and other organisms
(c) Heat, cold, humidity pressure, radiations
(d) All the above

334. Tuberculosis is caused by –
(a) Bacterium (b) Virus
(c) Protozoan (d) Malnutrition

335. Cholera, leprosy and diptheria are –
(a) Bacteria diseases (b) Viral diseases
(c) Fungal diseases (d) Functional diseases

336. Which disease is caused by a flagellate?
(a) Sleeping sickness (b) Dysentery
(c) Whooping cough (d) Jaundice

337. Cancer can be caused by the use of –
(a) Tobacco (b) Alcohol
(c) Opium (d) LSD

338. In order to prevent spreading of a communicable disease like Cholera it is necessary to –
(a) Control the population of mosquitoes.
(b) Dry up all ponds in the neighborhood.
(c) Educate people to drink boiled water and not to eat exposed food.
(d) Prevent others from coming in contact with the diseased person.

339. Virus causes the following disease in man –
(a) Influenza (b) Malaria
(c) Cholera (d) Diarrhoea

340. Which of the following is a communicable disease?
(a) Leucoderma (white patches on the skin)
(b) Diabetes mellitus
(c) Beri-beri
(d) Dysentery

341. Tuberculosis is a disease caused by –
(a) A type of bacteria (b) A virus
(c) A protozoan (d) Malnutrition

342. Which of the following can be used for biological control of mosquitoes?
(a) Oil (b) Ointments
(c) DDT (d) *Gambusia fish*

343. In addition to the immune system, we are protected from disease by –
(a) the skin
(b) mucous membranes
(c) natural secretions such as acids, protein-digesting enzymes, and antibiotics
(d) All of the above

344. Which scientist is credited with the development of medical vaccinations?
(a) Robert Koch (b) Charles Darwin
(c) Edward Jenner (d) William Harvey

345. The function of norepinephrine is –
(a) Almost similar to epinephrine
(b) Similar to ADH
(c) Opposite to epinephrine
(d) Opposite to ADH

346. Mammals born without a thymus gland fail to manufacture–
(a) B - Lymphocytes (b) T - Lymphocytes
(c) Plasma cells (d) Basophils

347. Both adrenaline and cortisol are secreted in response to stress. Which of the following statements is also true for both of these hormones –
(a) They act to increase blood glucose
(b) They are secreted by the adrenal cortex
(c) Their secretion is stimulated by adrenocorticotropin
(d) They are secreted into the blood within seconds of the onset of stress.

348. Estrogen is secreted by –
(a) Liver (b) Spleen
(c) Ovaries (d) Pituitary

349. Insulin by chemical nature is –
(a) Carbohydrate (b) Protein
(c) Steroid (d) Lipid

350. Melatonin is a hormone produced by –
(a) Adrenal gland (b) Pituitary gland
(c) Pineal gland (d) Thymus gland

351. Adrenaline hormone causes :
(a) Increase in blood pressure
(b) Increase in heart beat
(c) Both of them
(d) None of them

352. Cry protein is obtained from –
(a) *Bacillus thuringiensis* (b) *Baccilus subtillis*
(c) *Clostridium welchi* (d) *E. coli*

353. First transgenic plant –
(a) Potato (b) Tomato
(c) Tobacco (d) Maize

354. The bacteria generally used for genetic engineering is
(a) *Agrobacterium* (b) *Bacillus*
(c) *Pseudomonas* (d) *Clostridium*

355. *Bacillus thuringiensis* (Bt) strains have been used for designing novel –
(a) Bio-metallurgical techniques
(b) Bio-insecticidal plants
(c) Bio-mineralization processes
(d) Bio-fertilizers

356. The first antibiotic discovered was –
(a) Penicillin (b) Chloromycetin
(c) Cephalosporin (d) Streptomycin

357. Which of the following is false for Bt transgenic plant –
(a) Disease resistance
(b) Prepared by *Bacillus thuringiensis*
(c) It is recombinant type
(d) No such plant is known

358. First cloned animal is –
(a) Dog (b) Molly
(c) Dolly sheep (d) Polly sheep

359. Genetically engineered human insulin is prepared by using–
(a) *E. coli* (b) *Rhizopus*
(b) *Pseudomonas* (d) Yeast

360. Golden rice is a transgenic crop of the future with the following improved trait –
(a) High lysine (essential amino acid) content
(b) Insect resistance
(c) High protein content
(d) High vitamin-A content

361. Alpha diversity is present –
(a) Within community (b) Between community
(c) Ranges of communities (d) All the above

362. Biodiversity is determined by –
(a) Number of individuals in an area
(b) Species richness
(c) Evenness
(d) Both (b) and (c)

363. In which state "Periyar National park" is present –
(a) Karnataka (b) Maharashtra
(c) Madhya Pradesh (d) Kerala

364. Trishna sanctuary is located in –
(a) U.P. (b) Tripura
(c) West Bengal (d) J & K

365. Which Biosphere reserve is known as "Valley of Flower"
(a) Nilgiri (b) Sunderbans
(c) Uttarakhand (d) Nokrek

366. Which is preserved in National Park –
(a) Flora (b) Fauna
(c) Both (a) and (b) (d) None of these

367. Those species whose populations have been seriously depleted and whose ultimate security is not assured are known as –
(a) Threatened species (b) Endangered species
(c) Vulnerable species (d) Rare species

368. Which of the following has become extinct in India –
(a) Lion (b) Tiger
(c) Two horned Rhino (d) Dodo

369. Khaziranga wild life sanctuary is famous for –
(a) Tiger (b) Musk deer
(c) Elephant (d) Rhino

370. Which is the first national park established in India?
(a) Bandipur national park (b) Corbett national park
(c) Kanha national park (d) Periyar national park

371. The region which is greatly affected by air pollution is
(a) Thermosphere (b) Stratosphere
(c) Troposphere (d) Mesosphere

372. The substance which is a primary pollutant?
(a) H_2SO_4 (b) CO
(c) PAN (d) Aldehydes

373. Which of the following is most abundant hydrocarbon pollutant?
(a) Butane (b) Ethane (c) Methane (d) Propane

374. Which of the following causes lung cancer?
(a) Textiles (b) Asbestos
(c) Silica (d) Paper

375. Which of the following statement is false?
(a) London smog is oxidising in nature
(b) Photochemical smog causes irritation in eyes
(c) London smog is a mixture of smoke and fog
(d) Photochemkical smog results in the formation of PAN

376. Depletion of ozone layer causes
(a) Breast cancer (b) Blood cancer
(c) Lung cancer (d) Skin cancer

377. The gas responsible for ozone depletion :
(a) NO and freons (b) SO_2
(c) CO_2 (d) CO

378. Phosphate fertilizers when added to water leads to
(a) increased growth of decomposers
(b) reduced algal growth
(c) increased algal growth
(d) nutrient enrichment (eutrophication)

379. Pollution in large cities can be checked only by
(a) shifting of factories out of the residential area
(b) less use of insecticides
(c) proper disposal of organic wastes, sewage and industrial effluents
(d) All of the above

380. What causes death of fish in water bodies polluted by sewage?
(a) Foul smell
(b) Pathogens
(c) Clogging of gills by silt
(d) Decrease in D.O.

381. Which is the major air pollutant?
(a) He (b) O_2 (c) CO_2 (d) CO

382. The ozone layer is present in
(a) Stratosphere (b) Troposphere
(c) Thermosphere (d) Mesosphere

383. Which is related to 'Green House Effect'?
(a) Farming of green plants
(b) Farming of vegetables in houses
(c) Global warming
(d) Biodegradable pollutant

384. Biochemical Oxygen Demand, (BOD) is a measure of organic material present in water. BOD value less than 5 ppm indicates a water sample to be _____.
(a) rich in dissolved oxygen
(b) poor in dissolved oxygen
(c) highly polluted
(d) not suitable for aquatic life

385. Green chemistry means such reactions which
(a) produce colour during reactions
(b) reduce the use and production of hazardous chemicals
(c) are related to the depletion of ozone layer
(d) study the reactions in plants

386. Identify the wrong statement in the following:
(a) Chlorofluorocarbons are responsible for ozone layer depletion.
(b) Greenhouse effect is responsible for global warming.
(c) Acid rain is mostly because of oxides of nitrogen and sulphur.
(d) Ozone layer does not permit infrared radiation from the sun to reach the earth.

387. The statement which is not correct about control of particulate pollution
(a) In electrostatic precipitator, the particulates are made to acquire positive charge which are then attracted by the negative electrode and removed.
(b) Gravity settling chamber removes larger particles from the air.
(c) Cyclone collector removes fine particls in the diameter range 5-20 microns.
(d) Wet scrubbers are used to wash away all types of particulates.

388. Minamata disease is due to pollution of
(a) Aresenic into the atmosphere
(b) Organic waste into drinking water
(c) Oil spill in water
(d) Industrial waste mercury into fishing water

389. BOD is connected with
(a) microbes and organic matter
(b) organic matter
(c) microbes
(d) None of the above

390. Which among the following statements is false?
(a) Oil slick in sea water increases D.O. value.
(b) The main reason for river water pollution is industrial and domestic sewage discharge.
(c) Surface water contains a lot of organic matter mineral nutrients and radioactive materials.
(d) Oil spill in sea water causes heavy damage to fishery.

391. When rain is accompanied by a thunderstorm, the collected rain water will have a pH value
(a) Slightly lower than that of rain water without thunderstorm
(b) Slightly higher than that when the thunderstorm is not there
(c) Uninfluenced by occurrence of thunderstorm
(d) Which depends upon the amount of dust in air

392. Thermal pollution affects mainly
(a) vegetation (b) aquatic creature
(c) rocks (d) air

393. Which of the following is/are the hazardous pollutant(s) present in automobile exhaust gases?
(i) N_2 (ii) CO
(iii) CH_4 (iv) Oxides of nitrogen
(a) (ii) and (iii) (b) (i) and (ii)
(c) (ii) and (iv) (d) (i) and (iii)

394. Which one of the following statement is not true ?
(a) pH of drinking water should be between 5.5 – 9.5.
(b) Concentration of DO below 6 ppm is good for the growth of fish.
(c) Clean water would have a BOD value of less than 5 ppm.
(d) Oxides of sulphur, nitrogen and carbon are the most widespread air pollutant.

395. Which one of the following is an ore of silver ?
(a) Argentite (b) Stibnite
(c) Haematite (d) Bauxite

396. Cinnabar is an ore of
(a) Hg (b) Cu (c) Pb (d) Zn

397. Copper can be extracted from
(a) Kupfernical (b) Dolomite (c) Malachite (d) Galena

398. An example of an oxide ore is
(a) Bauxite (b) Malachite
(c) Zinc blende (d) Feldspar

399. Which of the following is an ore of tin ?
(a) Carborundum (b) Epsomite
(c) Cassiterite (d) Spodumene

400. Which of the following is chalcopyrite?
(a) $CuFeS_2$ (b) FeS_2
(c) $KMgCl_3.6H_2O$ (d) $Al_2O_3.2H_2O$

401. Haematite is the ore of :
(a) Pb (b) Cu (c) Fe (d) Au

402. A metal which is refined by poling is
(a) sodium (b) blister copper
(c) zinc (d) silver

403. Polymer obtained by condensation polymerization is
(a) Polythene (b) Teflon
(c) Phenol-formaldehyde (d) Nitrile rubber

404. Which one of the following is not an example of chain growth polymer?
(a) Neoprene (b) Buna-S
(c) PMMA (d) Glyptal

405. Teflon, styron and neoprene are all
(a) Copolymers
(b) Condensation polymers
(c) Homopolymers
(d) Monomers

406. P.V.C. is formed by polymerisation of
(a) 1-Chloroethene (b) Ethene
(c) Propene (d) 1-Chloropropene

407. The polymer of natural rubber is
(a) all *trans*-isoprene (b) Buna - N
(c) all *cis*-isoprene (d) none of these

408. Which of the following is not an example of addition polymer ?
(a) Polystyrene (b) Nylon
(c) PVC (d) Polypropylene

409. Which is an example of thermosetting polymer?
(a) Polythene (b) PVC
(c) Neoprene (d) Bakelite

410. A broad spectrum antibiotic is
(a) paracetamol (b) penicillin
(c) aspirin (d) chloramphenicol

411. Chloramphenicol is an
(a) analgesic (b) antipyretic
(c) antiseptic (d) antibiotic

412. Synthetic detergents are more effective in hard water than soaps because
(a) they are non-ionic
(b) their Ca^{++} and Mg^{++} salts are insoluble in water
(c) their Ca^{++} and Mg^{++} salts are water soluble
(d) they are highly soluble in water

413. Which of the following is used as a 'morning after pill'
(a) Norethindrone (b) Ethynylestradiol
(c) Mifepristone (d) Bithional

414. The use of chemicals for treatment of diseases is called as
(a) Homoeotherapy (b) Isothermotherapy
(c) Angiotherapy (d) Chemotherapy

415. Which of the following drugs is a tranquilizer and sedative
(a) Sulphadiazine (b) Papaverine
(c) Equanil (d) Mescaline

416. Streptomycin, well known antibiotic, is a derivative of
(a) peptides (b) carbohydrates
(c) purines (d) terpenes

417. Penicillin was first discovered by
(a) A. Fleming (b) Tence and Salke
(c) S. A Waksna (d) Lewis Pasteur

418. Washing soap can be prepared by saponification with alkali of which of the following oil
(a) Rose oil (b) Paraffin oil
(c) Groundnut oil (d) Kerosene oil

419. Soaps can be classified as :
(a) esters (b) salts of fatty acids
(c) alcohols (d) phenols

ANSWER KEY

1	(a)	46	(a)	91	(a)	136	(c)	181	(a)	226	(a)	271	(b)	316	(b)	361	(a)	406	(a)
2	(a)	47	(b)	92	(c)	137	(a)	182	(d)	227	(c)	272	(c)	317	(b)	362	(d)	407	(c)
3	(a)	48	(a)	93	(a)	138	(b)	183	(b)	228	(b)	273	(a)	318	(d)	363	(d)	408	(b)
4	(c)	49	(a)	94	(d)	139	(a)	184	(d)	229	(c)	274	(b)	319	(a)	364	(b)	409	(c)
5	(b)	50	(b)	95	(b)	140	(b)	185	(a)	230	(a)	275	(d)	320	(b)	365	(a)	410	(d)
6	(c)	51	(b)	96	(a)	141	(a)	186	(d)	231	(d)	276	(b)	321	(d)	366	(c)	411	(d)
7	(b)	52	(a)	97	(c)	142	(c)	187	(b)	232	(c)	277	(c)	322	(a)	367	(b)	412	(c)
8	(a)	53	(a)	98	(b)	143	(d)	188	(b)	233	(a)	278	(d)	323	(b)	368	(c)	413	(c)
9	(c)	54	(a)	99	(c)	144	(c)	189	(c)	234	(b)	279	(a)	324	(d)	369	(d)	414	(d)
10	(b)	55	(a)	100	(b)	145	(b)	190	(c)	235	(b)	280	(b)	325	(d)	370	(b)	415	(c)
11	(b)	56	(a)	101	(c)	146	(d)	191	(a)	236	(a)	281	(c)	326	(d)	371	(c)	416	(b)
12	(c)	57	(b)	102	(b)	147	(b)	192	(a)	237	(c)	282	(c)	327	(a)	372	(b)	417	(a)
13	(a)	58	(a)	103	(b)	148	(c)	193	(d)	238	(a)	283	(b)	328	(b)	373	(c)	418	(c)
14	(b)	59	(a)	104	(b)	149	(c)	194	(c)	239	(a)	284	(c)	329	(a)	374	(a)	419	(b)
15	(c)	60	(a)	105	(a)	150	(c)	195	(b)	240	(c)	285	(c)	330	(c)	375	(a)		
16	(b)	61	(a)	106	(a)	151	(d)	196	(b)	241	(c)	286	(d)	331	(a)	376	(d)		
17	(d)	62	(a)	107	(a)	152	(d)	197	(c)	242	(b)	287	(a)	332	(c)	377	(a)		
18	(a)	63	(d)	108	(b)	153	(c)	198	(d)	243	(c)	288	(a)	333	(b)	378	(d)		
19	(c)	64	(a)	109	(b)	154	(b)	199	(d)	244	(a)	289	(a)	334	(a)	379	(d)		
20	(a)	65	(c)	110	(d)	155	(d)	200	(a)	245	(b)	290	(c)	335	(a)	380	(d)		
21	(c)	66	(d)	111	(a)	156	(c)	201	(a)	246	(b)	291	(a)	336	(a)	381	(d)		
22	(b)	67	(a)	112	(d)	157	(a)	202	(c)	247	(d)	292	(a)	337	(a)	382	(a)		
23	(d)	68	(c)	113	(d)	158	(d)	203	(d)	248	(b)	293	(b)	338	(c)	383	(c)		
24	(b)	69	(a)	114	(d)	159	(b)	204	(a)	249	(b)	294	(c)	339	(a)	384	(a)		
25	(a)	70	(c)	115	(a)	160	(d)	205	(b)	250	(c)	295	(d)	340	(a)	385	(b)		
26	(a)	71	(a)	116	(b)	161	(d)	206	(a)	251	(c)	296	(b)	341	(c)	386	(d)		
27	(a)	72	(a)	117	(d)	162	(a)	207	(c)	252	(b)	297	(c)	342	(d)	387	(a)		
28	(c)	73	(b)	118	(c)	163	(d)	208	(a)	253	(a)	298	(d)	343	(d)	388	(d)		
29	(d)	74	(a)	119	(d)	164	(a)	209	(d)	254	(a)	299	(b)	344	(c)	389	(a)		
30	(d)	75	(a)	120	(c)	165	(c)	210	(a)	255	(d)	300	(c)	345	(a)	390	(a)		
31	(d)	76	(a)	121	(c)	166	(b)	211	(c)	256	(a)	301	(b)	346	(b)	391	(a)		
32	(a)	77	(b)	122	(c)	167	(d)	212	(d)	257	(b)	302	(c)	347	(a)	392	(b)		
33	(c)	78	(a)	123	(b)	168	(c)	213	(a)	258	(a)	303	(d)	348	(c)	393	(c)		
34	(a)	79	(c)	124	(c)	169	(a)	214	(b)	259	(d)	304	(b)	349	(b)	394	(b)		
35	(b)	80	(a)	125	(b)	170	(b)	215	(c)	260	(a)	305	(d)	350	(c)	395	(a)		
36	(a)	81	(b)	126	(d)	171	(d)	216	(b)	261	(b)	306	(d)	351	(c)	396	(a)		
37	(a)	82	(b)	127	(a)	172	(c)	217	(c)	262	(c)	307	(d)	352	(a)	397	(c)		
38	(a)	83	(d)	128	(d)	173	(c)	218	(a)	263	(d)	308	(a)	353	(c)	398	(a)		
39	(a)	84	(a)	129	(b)	174	(a)	219	(b)	264	(c)	309	(d)	354	(a)	399	(c)		
40	(a)	85	(b)	130	(d)	175	(b)	220	(b)	265	(d)	310	(b)	355	(b)	400	(a)		
41	(c)	86	(b)	131	(a)	176	(d)	221	(c)	266	(d)	311	(c)	356	(a)	401	(c)		
42	(c)	87	(c)	132	(b)	177	(b)	222	(a)	267	(d)	312	(b)	357	(d)	402	(b)		
43	(d)	88	(c)	133	(d)	178	(d)	223	(c)	268	(a)	313	(d)	358	(c)	403	(c)		
44	(d)	89	(c)	134	(c)	179	(d)	224	(b)	269	(b)	314	(a)	359	(a)	404	(d)		
45	(a)	90	(c)	135	(d)	180	(d)	225	(d)	270	(d)	315	(b)	360	(d)	405	(c)		

HINTS & EXPLANATIONS

14. (b) Work = Force × Displacement
If force and displacement both are doubled then work would be four times.

15. (c) Kinetic energy = $\frac{1}{2}mv^2$ $\therefore$ K.E. μ v^2
If velocity is doubled then kinetic energy will become four times.

34. (a) Let initial kinetic energy, $E_1 = E$
Final kinetic energy, $E_2 = E + 300\%$ of $E = 4E$
As

$$p \propto \sqrt{E} \Rightarrow \frac{p_2}{p_1} = \sqrt{\frac{E_2}{E_1}} = \sqrt{\frac{4E}{E}} = 2 \Rightarrow p_2 = 2p_1$$

$\Rightarrow p_2 = p_1 + 100\%$ of p_1
i.e. momentum will increase by 100%.

41. (c) Archimedes used the principle of buoyancy to find the purity of gold. According to which a body immersed in fluid experiences a buoyant force equal to the weight of the fluid it displaces. With the help of this principle, the density of the golden crown and solid gold was compared by balancing the crown on a scale with a reference piece, this set up is then immersed in water. If the crown is less dense than gold, it will displace more water, and thereby will experience a greater buoyant force than the reference piece.

42. (c) the kinetic energy of a non-rotating object of mass m traveling at a speed v is . If m and v are increased to twice its magnitude, then K.E= ½ X 2m X 2v X 2v = (8) = 8 times kinetic energy.

43. (d) The gravitational force is inversely proportional to the square of the distance: If you double the distance between the two bodies, the force of gravity is reduced to one-fourth its original value.

44. (d) Stationary wave can occur because the medium is moving in the opposite direction to the wave, or it can arise in a stationary medium as a result of interference between two waves travelling in opposite directions

66. (d) Speed of sound, doesn't depend on pressure and density of medium.

67. (a) In transverse waves medium particles vibrate perpendicular to the direction of propagation of wave.

106. (a) Spectacle lens is convex lens. Hence the defect in vision is of hypermetropia, far sighted.

124. (c) Fleming's right-hand rule (for generators) shows the direction of induced current when a conductor moves in a magnetic field. The right hand is held with the thumb, first finger and second finger mutually perpendicular to each other (at right angles).

125. (b) The watt (symbol: W) is a derived unit of power in the International System of Units (SI), named after the Scottish engineer James Watt (1736-1819).

126. (d) The NIOSH states "Under dry conditions, the resistance offered by the human body may be as high as 100,000 Ohms. Wet or broken skin may drop the body's resistance to 1,000 Ohms," adding that "high-voltage electrical energy quickly breaks down human skin, reducing the human body's resistance to 500 Ohms."

127. (a) The critical temperature for superconductors is the temperature at which the electrical resistivity of a metal drops to zero. The transition is so sudden and complete that it appears to be a transition to a different phase of matter; this superconducting phase is described by the BCS theory.

143. (d) Specific resistance of a wire depends on material and temperature.

155. (d) Ozone layer, also called ozonosphere, region of the upper atmosphere, between roughly 15 and 35 km (9 and 22 miles) above Earth's surface, containing relatively high concentrations of ozone molecules (O_3).

156. (c) In nuclear physics and nuclear chemistry, a nuclear reaction is semantically considered to be the process in which two nuclei, or else a nucleus of an atom and a subatomic particle (such as a proton, neutron, or high energy electron) from outside the atom, collide to produce one or more nuclides that are different from the nuclide(s) that began the process.

157. (a) In the photoelectric effect, electrons are emitted from solids, liquids or gases when they absorb energy from light. Electrons emitted in this manner may be called photoelectrons.

158. (d) a circle

162. (a) Synthetic fibres are also called polymers as they contain macromolecules with large number of repeating units.

165. (c) Maximum number of electrons present in M-shell are 18. The maximum number of electrons that can occupy a specific energy level can be found using the following formula.
Electron Capacity = $2n^2$, the variable n represents the Principal Quantum Number. Shell M has principle quantum number 3.

166. (b) Two oxygen atoms can both achieve stable structures by sharing two pairs of electrons joined in a double bond. O=O. Each line represents one pair of shared electrons.

167. (d) Helium is used by deep sea divers in their diving tanks as a substitute of nitrogen. The trouble with nitrogen in this situation is that nitrogen is a fairly heavy gas, and is soluble in blood at high pressure. Long term use of nitrogen can cause a strange sense of euphoria, or well being called nitrogen narcosis. This is a bit like being drunk, and makes the diver unable to assess dangers. Divers who work at depth or for long periods

use a mixture of 20% Oxygen and 80% Helium. Helium is used for a number of reasons - It is light, cheap, and does not dissolve in blood the same way that nitrogen does. Being inert it cannot be toxic to the diver or corrosive to equipment.

168. (c) The atomic number of uranium is 92, and the mass number of the isotope is given as 238. Therefore, it has 92 protons, 92 electrons, and 238 - 92 = 146 neutrons.

173. (c) An antacid is a substance which neutralizes stomach acidity.

174. (a) Annealing is the process by which both metal and glass are treated with heat in order to change their properties.

177. (b) Metals form basic oxides. For example oxide of calcium being basic is used to neutralise the acidity of soil.

178. (d) Steel an alloy of iron and carbon is used for manufacturing bridges.

179. (d) Non-metallic oxide could be acidic and neutral also. For example carbon dioxide (CO_2) is acidic in nature whereas carbon monoxide (CO) is neutral in nature.

181. (a) Graphite is the only non-metal, which is a good conductor of heat and electricity.

182. (d) Metals are both melleable and ductile. Metals can be drawn into thin sheets and wires.

184. (d) Phosphorus is a non-metal and non-metals have low melting and boiling points. Although, sodium is a metal, it has low melting and boiling point.

185. (a) Brass is an alloy made of copper and zinc; the proportions of zinc and copper can be varied to create a range of brasses with varying properties.

186. (d) Wrought iron is an iron alloy with a very low carbon content, in comparison to steel, and has fibrous inclusions, known as slag. This is what gives it a "grain" resembling wood, which is visible when it is etched or bent to the point of failure. Wrought iron is tough, malleable, ductile and easily welded.

187. (b) Galvanization, or galvanisation, is the process of applying a protective zinc coating to steel or iron, to prevent rusting. The most common method is hot-dip galvanization, in which parts are submerged in a bath of molten zinc.

188. (b) A homogeneous mixture is a type of mixture in which the composition is uniform and every part of the solution has the same properties. A homogeneous mixture in which there is both a solute and solvent present is also a solution.

191. (a) Devarda's alloy , is an alloy of aluminium (44% - 46%), copper (49% - 51%) and zinc (4% - 6%). Devarda's alloy is used as reducing agent in analytical chemistry for the determination of nitrates after their reduction to ammonia under alkaline conditions. It owes its name to the Italian chemist Arturo Devarda (1859-1944), who synthezised it at the end of the 19th century to develop a new method to analyze nitrate in Chile saltpeter.

192. (a) Cysteine (abbreviated as Cys or C) is an α-amino acid with the chemical formula $HO_2CCH(NH_2)CH_2SH$. It is a semi-essential amino acid, which means that it can be biosynthesized in humans. The thiol side chain in cysteine often participates in enzymatic reactions, serving as a nucleophile.

193. (d) Neon is a chemical element with symbol Ne and atomic number 10. It is in group 18 (noble gases) of the periodic table. Neon is a colorless, odorless, inert monatomic gas under standard conditions, with about two-thirds the density of air.

194. (c) by tracheal system

195. (b) annihilate each other

196. (b) Cryolite (Na_3AlF_6, sodium hexafluoroaluminate) is an uncommon mineral identified with the once large deposit at Ivigtût on the west coast of Greenland, depleted by 1987.

197. (c) Glucose ($C_6H_{12}O_6$, also known as D-glucose, dextrose, or grape sugar) is a simple monosaccharide found in plants. It is one of the three dietary monosaccharides, along with fructose and galactose, that are absorbed directly into the bloodstream during digestion.

198. (d) Zinc metal is non-malleable and brittle in nature.

199. (d) Usually the non-metals are dull in appearance but iodine is an exception which has a luster.

200. (a) Mercury

217. (c) Two pollutants emitted by motor vehicles react to form ground-level ozone or smog which can cause respiratory problems and reduce visibility.

221. (c) Cardiac muscle is an involuntary striated muscle tissue found only in the organ heart. Involuntary muscles are smooth muscles that are not directly controllable at will. For example You don't have to remind yourself to make your heart beat, so it is involuntary. Voluntary muscles are controllable like those found in your arms, legs, hands, etc.

223. (c) Ringworm is common disease, especially among children. It is caused by a fungus, not a worm like the name suggests. It is a common and highly infectious skin infection that causes a ring-like red rash on the skin.

230. (a) Thorium is an element which are used in radioactive chemicals where all other three options are power generating systems which are regenerated.

231. (d) Dekke Toba fish in found in Indonesia. Lake Toba (Indonesian: Danau Toba) is a lake and supervolcano. The lake is 100 kilometres long, 30 kilometres wide, and up to 505 metres (1,666 ft) deep. The fauna includes several species of zooplankton and benthic animals. Since the lake is oligotrophic (nutrient-poor), the native fish fauna is relatively scarce, and the only endemics are Rasbora tobana.

232. (c) Timber means wood that we obtain from plants are called renewable in the sense that after cutting a tree if we plant another tree then it will grow up and again give us wood and timber whereas all other things given are non-renewable, once the stock is finished we cannot get more of it.

233 (a) chegonium, the female reproductive organ in ferns and mosses. An archegonium also occurs in some gymnosperms, e.g., cycads and conifers. A flask-

shaped structure, it consists of a neck, with one or more layers of cells, and a swollen base-the venter-which contains the egg.

234. (b) Trochodendron is a genus of flowering plants with one living species, Trochodendron aralioides, and six extinct species known from the fossil record.

235. (b) Study of ants is called Myrmecology.

236. (a) A Reverse transcriptase (RT) is an enzyme used to generate complementary DNA (cDNA) from an RNA template, a process termed reverse transcription. RT is needed for the replication of retroviruses (e.g., HIV), and RT inhibitors are widely used as antiretroviral drugs.

237. (c) The plant epidermis consists of three main cell types: pavement cells, guard cells and their subsidiary cells that surround the stomata.

238. (a) As sugar concentration increases in the guard cells, as a result water enters the guard cells. The guard cells become turgid (swollen with water). The thin outer walls bulge out and force the inner wall into a crescent shape. In this way a stoma or pore is formed between each pair of guard cell.

239. (a) Revegetation is often used to join up patches of natural habitat that have been lost, and can be a very important tool in places where much of the natural vegetation has been cleared. It is therefore particularly important in urban environments, and research in Brisbane has shown that revegetation projects can significantly improve urban bird populations. The Brisbane study showed that connecting a revegetation patch with existing habitat improved bird species richness, while simply concentrating on making large patches of habitat was the best way to increase bird abundance.

240. (c) A dust storm or sand storm is a meteorological phenomenon common in arid and semi-arid regions. Dust storms arise when a gust front or other strong wind blows loose sand and dirt from a dry surface.

241. (c) Mahyco, an Indian seed company based in Jalna, Maharashtra, has developed the Bt brinjal. The genetically modified brinjal event is termed Event EE 1 and Mahyco have also applied for approval of two brinjal hybrids.

246. (b) A dendritic drainage pattern refers to the pattern formed by the streams, rivers, and lakes in a particular drainage basin. It usually looks like the branching pattern of tree roots and it mainly develops in regions underlain by homogeneous material.

247. (d) A halophyte is a plant that grows in waters of high salinity, coming into contact with saline water through its roots or by salt spray, such as in saline semi-deserts, mangrove swamps, marshes and sloughs, and seashores. An example of a halophyte is the salt marsh grass Spartina alterniflora (smooth cordgrass).

248. (b) Azotobacter is a genus of usually motile, oval or spherical bacteria that form thick-walled cysts and may produce large quantities of capsular slime.

249. (b) The aorta is the largest artery in the human body, originating from the left ventricle of the heart and extending down to the abdomen, where it bifurcates into two smaller arteries (the common iliac arteries). The aorta distributes oxygenated blood to all parts of the body through the systemic circulation.

250. (c) Parathyroid hormone (PTH), parathormone or parathyrin, is secreted by the chief cells of the parathyroid glands as a polypeptide containing 84 amino acids. It acts to increase the concentration of calcium (Ca^{2+}) in the blood, whereas calcitonin (a hormone produced by the parafollicular cells (C cells) of the thyroid gland) acts to decrease calcium concentration.

251. (c) Extratropical cyclones, sometimes called mid-latitude cyclones or wave cyclones, are a group of cyclones defined as synoptic scale low pressure weather systems that occur in the middle latitudes of the Earth (outside the tropics) not having tropical characteristics, and are connected with fronts and horizontal gradients in temperature and dew point otherwise known as "baroclinic zones".

252. (b) Any of the homologous segments, lying in a longitudinal series, that compose the body of certain animals, such as earthworms and lobsters. Also called somite.

260. (a) The pancreas is a glandular organ in the upper abdomen, but really it serves as two glands in one: a digestive exocrine gland and a hormone-producing endocrine gland. Functioning as an exocrine gland, the pancreas excretes enzymes to break down the proteins, lipids, carbohydrates, and nucleic acids in food. Functioning as an endocrine gland, the pancreas secretes the hormones insulin and glucagon to control blood sugar levels throughout the day.

261. (b) Due to the action of motor cells at the base of the petiole and leaflets, the leaves of touch me not plant closes. The motor cells are activated by touch of the sensitive hairs present on the surface of touch-me-not plant. Like a number of other plant species, it undergoes changes in leaf orientation termed "sleep" or nyctinastic movement. The foliage closes during darkness and reopens in light.

262. (c) The theoretical basis for plant tissue culture was proposed by Gottlieb Haberlandt, German Academy of science in1902 on his experiments on the culture of single cell.

263. (d) Beak is technically only the external surface of a bird's mouth. The entire mouth structure of a bird is called the bill. The bill (or rostrum) consists of a bony framework, a vascular layer containing the blood vessels and nerves, a layer of connective tissue, which "glues" the beak to the bones, and the beak, which is the outer sheath covering the jaw bones. The beak is composed of keratin - the same tough, insoluble protein found in fingernails, hoofs, antlers and horns.

264. (c) External ear is present in Mammals. Many mammals can move the pinna (with the auriculares muscles) in order to focus their hearing in a certain direction in much the same way that they can turn their eyes. Most humans, unlike most other mammals, do not have this ability.

268. (a) The function of red blood cells is to transport oxygen to the cells of the body.

269. (b) Because the blood plasma is about 90% water.

275. (d) All of these choices are different types of fungi. Mushrooms are classified as basidiomycetes. Yeasts are ascomycetes. Water molds are oomycetes. Fungi come in many different shapes and sizes. They are also found almost anywhere in the world.

276. (b) A flagellum is a tail-like structure used to help single-celled organisms move. The tail is whipped in a circular motion and the cell is able to move in one direction. It's not the most efficient way of moving around, but it gets the job done.

277. (c) We will not find a nucleus in bacteria. Bacteria are prokaryotic organisms. We may even find cell walls, but they are a different structure than those found in plants. Bacteria have cell membranes and cell walls. Their cell walls are not like the cell walls of plants. They are not made of cellulose.

278. (d) All of those organisms are fungi. Truffles are found in the forest.

279. (a) Mushrooms are classified as basidiomycetes because of their shape during development. The two basic parts of a mushroom are the underground hyphae and basidiocarp top.

280. (b) The color of lichen usually comes from the pigments inside of the algae. There is a wide variety of colors for three basic lichen shapes.

281. (c) Lichens have two organisms that have a mutually beneficial relationship. Both organisms survive because of the other. The alga creates food and the fungus offers protection and nutrients.

282. (c) Flesh eating bacteria is a bacterial infection. The other choices were all caused by one type of virus or another.

283. (b) Cell wall of bacteria is made up of peptidoglycan which consists of polysaccharides and amino acids.

284. (c) Under aerobic conditions cyanobacteria fix atmospheric N_2 as Ammonia by special cells called heterocysts.

285. (c) Archaebacteria is a group of primitive prokaryotes, which were the earliest organisms to have appeared on the earth.

286. (d) Plasmids are additional rings of DNA which can replicate independently. Some of them contain genes for fertility and drug resistance.

287. (a) Bacteria shows anoxygenic photosynthesis

$$CO_2 + H_2S \xrightarrow[\text{energy}]{\text{light}} \text{sugars} + \text{sulphur} + \text{water}$$

288. (a) Azatobacter is free living nitrogen fixing bacteria, capable of picking up free nitrogen and fixing it in some organic compounds like amino acids.

289. (a) Mycoplasma differs from bacteria in not having a cell wall because of which mycoplasma can also change its shape.

290. (c) Yeast has well defined nucleus which bacteria does not have.

291. (a) Yeast being unicellular form short, temporary filamentous structure called Pseudomycelium.

292. (a) The fungal partner of Lichens is called a mycobiont and algal partner is called a phycobiont.

293. (b) Fungi imperfecti is a group which includes those fungi that reproduce exclusively by vegetative and asexual methods. They are also known as deuteromycetes.

294. (c) Edward Jenner is known as father of Immunology.

295. (d) AIDS is caused by Human Immunodeficiency virus (HIV).

296. (b) BCG is vaccine for Tuberculosis and was given by Chalmette Guerin.

297. (c) Polio results in paralysis of limbs in infants.

298. (d) Goitre is caused due to deficiency of Iodine.

299. (b) The host cell invaded by a virus produces an antiviral protein called interferon which prevents the viral multiplication.

300. (c) Diabetes is caused due to increased glucose level in blood when insulin is not produced by pancreas in required amount.

303. (d) Pandemic disease is a disease effective over wide geographic area.

305. (d) Sleeping sickness is caused by Trypanosoma.

313. (d) Autoimmunity is an immune disorder when immune system of a person rejects its own body cells.

328. (b) Sir Alexander Flemming (1851-1955) of Britain discovered the first antibiotic 'penicillin' in 1929. He was awarded Nobel prize for the same in 1945.

334. (a) Tuberculosis is a bacterial disease caused by Mycobacterium tuberculosis.

337. (a) Benzpyrene present in tobacco smoke is carcinogenic. About 95% victims of lung cancer are due to smoking. Bidi smoking cause cancer of tongue, pharynx, larynx, tonsils and oesophagus. Tobacco chewing leads to oral cancer.

338. (c) Cholera is an acute communicable disease which is caused by a parasite, Vibro Comma. The parasite is communicated through water and exposed food especially cut-fruits.

344. (c) Edward Jenner was the first person to vaccinate people against disease.

350. (c) Melatonin is a hormone produced by Pineal gland

351. (c) Adrenaline hormone causes increase in blood pressure, heart beat.

367. (b) Those species whose populations have been seriously depleted and whose ultimate security is not assured are known as endangered species.

369. (d) *Rhinoceros unicornis* (Rhino) are protected in Kaziranga sanctuary at Sibsagar, is situated in Assam which has started in 1987.

371. (c) Air pollution greatly affect the troposphere.

373. (c) Most abundant hydrocarbon pollutant is methane.

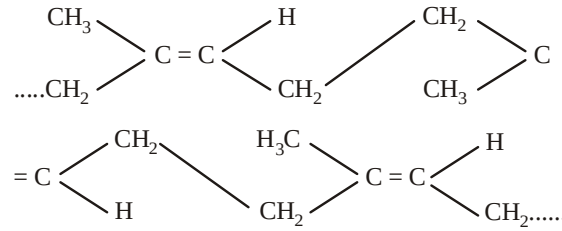
374. (a) Textiles cause lung cancer.

375. (a) London smog is reducing in nature.

376. (d) Depletion of ozone layer causes skin cancer.

378. (d) Addition of phosphate fertilizers to water leads to nutrient enrichment (eutrophication).

381. (d) CO is major air pollutant.
382. (a) Ozone layer is present in stratosphere.
385. (b) Green chemistry may be defined as the programme of developing new chemical products and chemical processes or making improvements in the already existing compounds and processes so as to make less harmful to human health and environment. This means the same as to reduce the use and production of hazardous chemicals.
386. (d) Ozone layer acts as a shield and does not allow ultraviolet radiation from sun to reach earth. It does not prevent infra-red radiation from sun to reach earth, thus option (d) is wrong statement and so it is the correct answer.
387. (a) Particulates acquire negative charge and are attracted by the positive electrode.
388. (d) Minamata is caused by Hg poisoning.
389. (a) BOD is connected with microbes and organic matter.
390. (a) Oil slick in sea water decreases D.O value.
391. (a) Normal rain water has pH 5.6 Thunderstorm results in the formation NO and HNO_3 which lowers the pH.
392. (b) Thermal pollution is caused by power plants. Power plant requires a larger quantity of water for cooling. The water after cooling is left in the water body. The temperature of left water is generally very high and affects aquatic life.
393. (c) CO and oxides of Nitrogen are poisnous gases present in automobile exhaust gases.
394. (b) The ideal value of D.O. for growth of fishes is 8 mg/ℓ. 7 mg ℓ is desirable range, below this value fishes get susceptible to desease. A value of 2 mg/ℓ or below is lethal for fishes.
395. (a) Argentite or silver glance (Ag_2S) is an ore of Ag.
396. (a) Cinnabar (HgS) is an ore of Hg.
397. (c) Malachite is $CuCO_3 . Cu(OH)_2$ it is ore of copper.
398. (a) Bauxite ore of aluminium is $Al_2O_3.2H_2O$.
399. (c) Carborundum - SiC
Epsomite or Epsom salt - $MgSO_4.7H_2O$
Cassiterite - SnO_2
Spodumene - Ore of lithium
400. (a) Chalcopyrite : $CuFeS_2$
Fool's gold : FeS_2
Carnalite : $KMgCl_3.6H_2O$
Bauxite : $Al_2O_3.2H_2O$
401. (c) Haematite is Fe_2O_3. Thus it is the ore of iron (Fe).
402. (b) Polling is used for purification of metal which contain their own oxide as impurity e.g., Cu_2O in Cu, SnO_2 in Sn etc.
403. (c) All the other three polymers are obtained by addition polymerisation.
404. (d) Glyptal is an example of a step growth polymer.
406. (a) P.V.C. (Polyvinyl chloride) is formed by polymerisation of vinyl chloride, CH_2 =CHCl, whose IUPAC name is 1-chloroethene.
407. (c) Natural rubber is *cis*-1, 4 poly isoprene and has only *cis* configuration about the double bond as shown below.



408. (b) Nylon is a condensation polymer
409. (c) Bakelite is a thermosetting polymer. On heating it is infusible and cannot be remoulded.
411. (d) Obtained from streptomyces venezuelae (fungi). It is very effective in typhoid fever.
412. (c) Structural features of soaps and detergents are almost same except that the polar end in detergents is $-OSO_3^-Na^+$ while in soaps polar end is $-COO^-Na^+$. Detergents have an advantage over soaps that its polar end sulphate and sulphonate retain their efficiency in hard water, since the corresponding Ca and Mg salts are soluble. Being salts of strong acids, they yield neutral solution, in contrast, to the soaps, which being salts of weak acids yield slightly alkaline solutions.
415. (c) Tranquilizers reduce anxiety and tension they are also called psychototropic drugs. These are two type
(i) Sedative the drugs used for violent and mentale agitated patient e.g.., Equanil and diazepam.
(ii) Antidepressant- The drug are used to patients who are highly depressed and lose self confidence e.g. tofranil vitalin, amphetamine etc.
417. (a) A. Fleming discovered penicillin in 1929.
418. (c) Any oils which are good for eating or cooking, can be used in making soap. One of the best is said to be Coconut oil. Groundnut, Shea butter, Cocoa butter, Sun flower and many other vegetable oils are also used.
419. (b) Soaps are actually salts of higher fatty acids.
Example : $C_{17}H_{35}COONa$
(sodium stearate)

This chapter is taken from :