SECTION-A

1. Carbon

2. Group seventeen elements

3. (i) Decomposition reaction
   (ii) Double displacement reaction.

OR

Antioxidants are added to foods high in oil and fat to prevent rancidity. Antioxidants prevent oxidation of fats and oils.

4. Refractive index of glass with respect to air, $_a n_g = \dfrac{3}{2}$

   $\therefore$ Refractive index of air with respect to glass, $_g n_a = \dfrac{1}{_a n_g} = \dfrac{1}{3/2} = \dfrac{2}{3}$

5. The blue colour of water in deep sea is due to scattering of light, as the blue colour being of shorter wavelength scattered most by water molecules.

OR

Scattering of light.

6. When the object is at infinity, its virtual, erect and point sized image is formed at the focus of concave lens. When the object is moved towards the lens, the image is also moved from the focus, towards the lens and its size increases.

OR

When the incident ray falls normally on the glass slab, it will refract without deviation, i.e., along the normal in the glass slab. In this situation, $\angle i = \angle r = 0°$.

7. Electrons are flowing through the wire from lower potential end (negative terminal of cell) to higher potential end (positive terminal of cell).

OR

The relation between potential difference, work done and charge moved is given by,

Potential difference = $\dfrac{\text{Work done}}{\text{Charge moved}}$

i.e. $V = \dfrac{W}{q}$

8. According to right hand thumb rule, if you hold the wire in right hand, keeping thumb from East to West, the curved fingers will direct from South to North at a point lying directly above the wire.

9. Trypsin

OR

Cow and Lion

10. In homozygous condition two factors of a character are same (TT).

11. The inter - connected food chains operating in an ecosystem which establish a network of relationships between various species is called a food web.

12. (i) Mitral or bicuspid valve
    (ii) Tricuspid valve

13. Option (4)

14. Option (1)

15. Option (2)

OR

Option (4)

16. Option (1)

Power of lens, $P = \dfrac{1}{\text{Focal length, f(in m)}}$

17. (a) Option (2)

(b) Option (3)

(c) Option (4)

(d) Option (4)

(e) Option (1)

18. (a) Option (4)

(b) Option (2)

(c) Option (3)

(d) Option (1)

(e) Option (3)

19. (a) Option (3)

Conductor A : $R_A = \rho \dfrac{\ell}{A} = R$ and After stretching, $R'_A = 2^2 R_A = 4R$

Conductor B : $R_B = 2R$ and for half length of conductor, $R'_B = \dfrac{2R}{2} = R$

So, $\dfrac{R'_A}{R'_B} = \dfrac{4R}{R} = \dfrac{4}{1}$

(b) Option (3)

Slope of V-I graph gives resistance of the conductor. Silver has least resistance among the given conductor samples here. So its slope for V-I graph will be least.

(c) Option (1)

$R = \rho \dfrac{\ell}{A} = \rho \cdot \dfrac{\ell}{\pi r^2} = 20\,\Omega$ (given)

Now, $r' = \dfrac{r}{2}$, $\ell' = \ell$

$\therefore$ $R' = \rho \dfrac{\ell'}{A'} = \rho \cdot \dfrac{\ell}{\pi \left(\dfrac{r}{2}\right)^2} = 4R = 4 \times 20 = 80\ \Omega$

(d) Option (4)

$$R = \rho \frac{\ell}{A} = \rho \frac{\ell}{\pi r^2} \qquad \Rightarrow \qquad R \propto \frac{1}{r^2}$$

(e) Option (2)

20. (a) Option (2)

The stick partly immersed in water appears to be bent due to refraction of light.

(b) Option (4)

Refractive index of water,

$$n_W = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in water}}$$

$$\Rightarrow \quad \frac{4}{3} = \frac{3 \times 10^8}{v}$$

$$\Rightarrow \quad v = 2.25 \times 10^8 \text{ ms}^{-1}$$

(c) Option (2)

When a ray of light incidenting obliquely, passes through a rectangular glass slab, the emergent ray is parallel to the incident ray, having some lateral shift from incident ray. This is shown only in figure B.

(d) Option (3)

In the experiment of refraction through a glass slab,

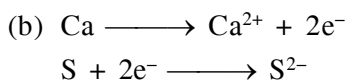Angle of incidence = Angle of emergence

This is observed by Suresh only. So, he has performed the experiment with all resources and sincerity.

(e) Option (3)

When a ray of light goes obliquely from optically rarer medium to optically denser medium, it bends towards the normal, at the point of incidence.

Air is optically rarer than water. So, when light ray goes from air to water, it bends towards the normal.

SECTION-B

21. (a) Ca**:**   **:S̈:**
    2, 8, 8, 2   2, 8, 6

(b) Ca $\longrightarrow$ Ca^{2+} + 2e$^-$

S + 2e$^-$ $\longrightarrow$ S^{2-}

Ca $\overset{\times}{\underset{\times}{\Longrightarrow}}$ S̈:   (Ca^{2+})   ($^{\times}_{\times}$S̈:$^{2-}$)

OR

The colour of the pH paper will not change because solid sodium bicarbonate does not produce ions and thus does not give any colour on pH paper.

22. Covalent bond are of three types

(a) Single covalent bond : A single covalent bond is formed by the sharing of one pair of electrons between the two atoms.

eg H$_2$ or H – H

(b) Double covalent bond : A double covalent bond is formed by the sharing of two pairs of electrons between the two combining atoms

eg. O_2 or $O = O$

(c) Triple covalent bond : A triple covalent bond is formed by the sharing of three pairs of electrons between the two combining atoms.

eg N_2 or $N \equiv N$

23. **Differences between asexual and sexual reproduction (any two)**

Features	Asexual reproduction	Sexual reproduction
Number of parents involved	One	Two
Resemblance with parents	Organisms produced resemble exactly with the parent.	Organisms do not resemble exactly with the parent but resemble in certain features with both the parents.
Type of cell divisions	Amitotic / mitotic.	Mitotic and meiotic both are present.
Time duration for multiplication	Takes less time.	Takes more time.
Variations	Variations are very less.	Variations are present.
Adaptability	Organisms produced have less adaptability.	Organisms produced have more adaptability.

OR

When the male and female reproductive parts are present in the same flower, it is called a bisexual flower e.g. Hibiscus, Mustard.

When the male and female reproductive parts are present in different flowers, they are called unisexual flowers e.g.Papaya, Date palm, Mulberry, Gourd, Water melon. (any two)

24.

	Organisms	Excretory Organ	Waste products
(i)	Earthworm	Nephridia	Ammonia or urea
(ii)	Insects	Malpighian tubules	Uric acid
(iii)	Flatworm	Protonephridia (flame cells)	Mainly ammonia
(iv)	Humans	Kidneys	Urea

25. $h_0 = 1.2$ cm, $f = -20$ cm, $v = -60$ cm

Mirror formula, $\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u}$

$\Rightarrow \quad \dfrac{1}{u} = \dfrac{1}{f} - \dfrac{1}{v}$

$\Rightarrow \quad \dfrac{1}{u} = \dfrac{1}{-20} - \dfrac{1}{-60} = \dfrac{-1}{20} + \dfrac{1}{60} = \dfrac{-3+1}{60} = \dfrac{-1}{30}$

$\Rightarrow \quad u = -30$ cm

Also, $\dfrac{h_i}{h_0} = \dfrac{-v}{u} \qquad \Rightarrow h_i = -\dfrac{-60}{-30} \times 1.2 = -2.4$ cm

26. Let the areas of two wires be A_1 and A_2, where

$\dfrac{A_1}{A_2} = \dfrac{8}{5}$ (given), which indicates that wire of area A_1 is thicker.

Given, resistance R_1 of wire of area $A_1 = 10\ \Omega$

As both the wires are of same material and same length, hence resistivity ρ will be same for both of them and length $\ell_1 = \ell_2 = \ell$ (say)
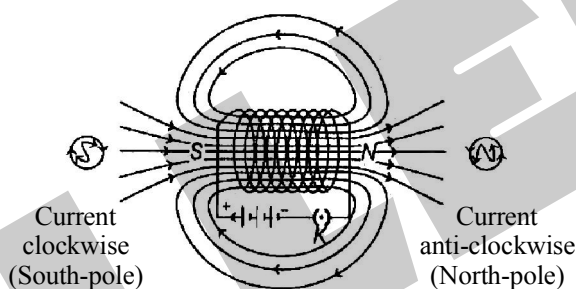
Now,

$$\dfrac{R_1}{R_2} = \dfrac{\left(\dfrac{\rho\ell}{A_1}\right)}{\left(\dfrac{\rho\ell}{A_2}\right)} = \dfrac{\rho\ell}{A_1} \times \dfrac{A_2}{\rho\ell} = \dfrac{A_2}{A_1} = \dfrac{5}{8} \qquad \left(\because R = \rho\dfrac{\ell}{A}\right)$$

$$\Rightarrow \quad \dfrac{10}{R_2} = \dfrac{5}{8} \quad \text{or} \quad R_2 = \dfrac{80}{5} = 16\ \Omega$$

OR

Magnetic lines of force due to a current carrying solenoid are shown in figure below.

Current clockwise (South-pole)   Current anti-clockwise (North-pole)

Magnetic pole formation at the ends of solenoid can be explianed by looking at one face of the solenoid coil. If the direction of current through the coil is seen clokwise by looking at a face of solenoid coil, then that face has South polarity and if the direction of current is anti-clocwise, then that face has North polarity.
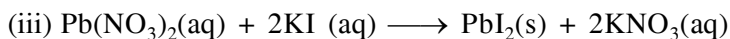
SECTION-C

27. (i) MnO_2 loses oxygen, therefore it is an oxidant while HCl gains oxygen, therefore it is a reductant.

(ii) CuO is oxidant, while H_2 is reductant.

(iii) PbO is oxidant, while C is reductant.

28. (i) $Cu(s) + 2AgNO_3\ (aq) \longrightarrow Cu(NO_3)_2(aq) + 2Ag$
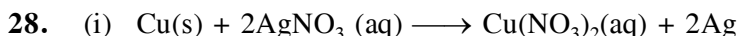
The solution will become blue in colour and shiny silver metal will be deposited.

(ii) $NaOH + HCl \longrightarrow NaCl + H_2O + heat$
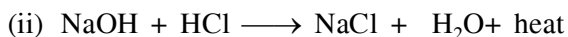
The temperature will increase because heat will be evolved.

(iii) $Pb(NO_3)_2(aq) + 2KI\ (aq) \longrightarrow PbI_2(s) + 2KNO_3(aq)$

Yellow ppt

Yellow precipitate of PbI_2 will be formed

OR

On scrubbing, its colour changes from yellow to reddish brown. It happens because soap is basic in nature and the colour of turmeric changes from yellow to reddish brown in basic medium. When the shirt is washed with plenty of water, the stain turns yellow again.

29. The phenonmenon of existence of an element in two or more forms which have different physical properties but identical chemical properties is called as allotropy.

Properties of diamond

(i) It is transparent and colourless.

(ii) It sparkles brightly because it reflects most of light.

30. (i) Ten Percent law was put forth by Lindeman (1942). According to this law, transfer of energy from one trophic level to other trophic level is never 100 percent. It is so because most of energy gets lost as heat in the environment during each transfer. On an average, about 10% of energy is actually available to the next trophic level.

(ii) **Importance of decomposers**

1. They decompose the dead bodies of animals and plants thus acts as cleansing agents of the environment.

2. They help in recycling the material in biosphere thus, play a vital role in biogeochemical or nutrient cycles.

3. They maintain the fertility of soil.

4. If there were no decomposers, the earth would have been a heap of dead organisms.

OR

S.No.	Biodegradable waste	Non-biodegradable waste
1.	They can be broken down into simpler substances by the activity of biological catalysts called enzymes (present in surrounding bacteria or other saprophytes). Physical processes like heat and temperature help in the functioning of enzymes.	They can't be broken down into simpler and harmless products because the biological catalysts called enzymes can't act upon them. They can be acted upon only by some physical processes like heat and pressure.
2.	They can enter the biogeochemical cycles.	They cannot enter the biogeochemical cycles.
3.	They become pollutants only when they accumulate in large quantities and not degraded at the right time.	They always act as pollutants whether present in small or large quantity.
4.	All the biodegradable wastes should be treated properly before discharging them into water or soil.	They can't be treated properly before discharging them into water or soil. Instead, they can be either recycled or reused.
5.	They do not persist in the environment for a long time.	They persist in the environment for a long time.
6.	For example, Urine and faecal matter, Sewage, Paper, Vegetable and fruit peels, Agricultural residues, Wood and Cloth. (any two)	For example, Heavy metals like Mercury, Lead, Arsenic, Radioactive wastes like Uranium, Plutonium, Insecticides and Pesticides like DDT and BHC. (any two)

**31.** Pairs of allelic characters found in garden pea plant (any three)

	Properties	Dominant	Recessive
1	Height	Tall	Dwarf
2	Colour of seed	Yellow	Green
3	Colour of pod	Green	Yellow
4	Colour of flower	Violet	White
5	Shape of seed	Round	Wrinkled
6	Shape of pod	Inflated	Constricted
7	Position of flower	Axial	Terminal

32. (i)
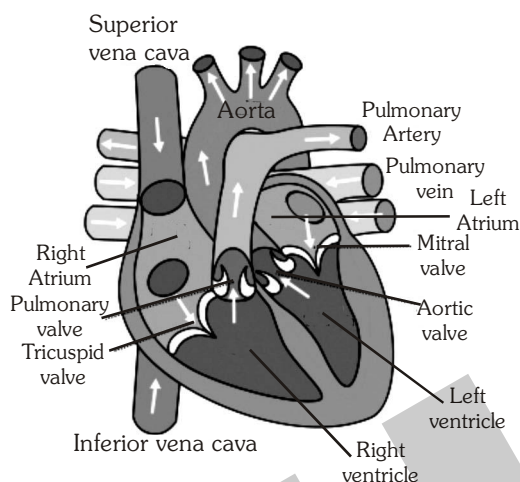
(ii) RBC mainly transports oxygen from the lungs to all tissues of the body. It also returns some amount of carbon dioxide from the tissues back to the lungs.

33.
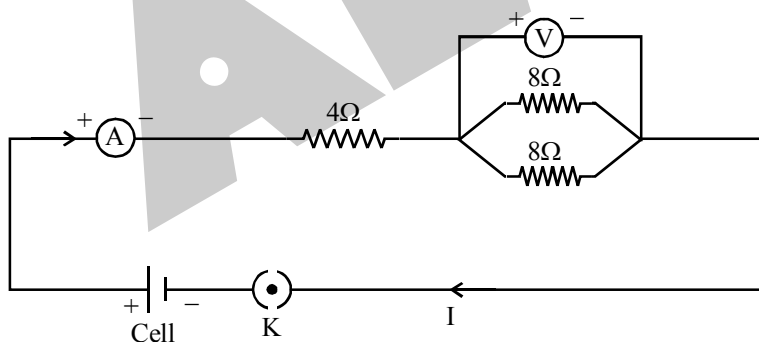
Maximum current through 4Ω resistor,

$$I = \sqrt{\frac{P}{R}} = \sqrt{\frac{16}{4}} = 2 \text{ A} \qquad \text{(Using relation, } P = I^2R\text{)}$$

Therefore, Maximum current through each 8Ω resistor,

$$I' = \frac{1}{2} \times 2 = 1A$$

SECTION-D

34. Across a period from left to right, number of valence electrons increases from 1 to 7 in the same valence shell. As a result effective nuclear charge acting on valence electrons increases and tendency to lose electrons decreases and tendency to gain electrons increases. Thus metallic character decreases across a period.

The decreasing order of atomic size of group 2nd elements is

Ba > Sr >Ca > Mg > Be.

Fluorine is the most electronegative element among group 17 elements.

OR

(i) Tap water contains ions which conduct electricity. Distilled water does not contain ions.

(ii) Dry HCl does not produce ions but dilute HCl gives H^+ and Cl^-.

(iii) Baking soda does not allow milk to change into lactic acid, which makes milk sour.

(iv) Diluting an acid is highly exothermic. Water should not be added to concentrated acid because the heat generated may cause the mixture to splash out and cause burns. Thus, acid is added to water.

(v) Curd and sour substance contain acid which react with copper and brass to form certain salts that are poisonous in nature and can cause food poisoning.

35.
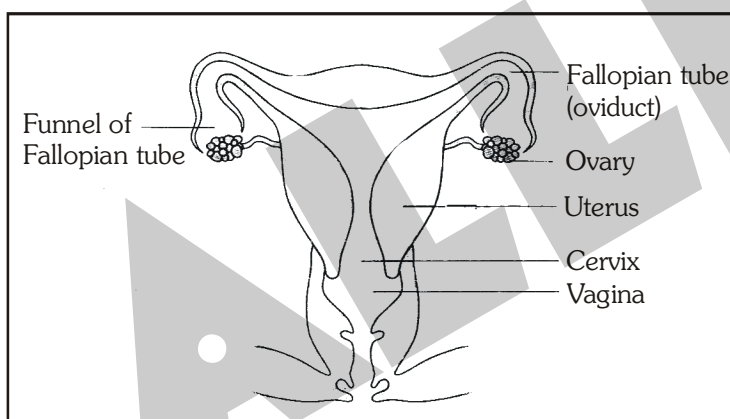
Female reproductive system

Female reproductive system in humans consist of :

(1) Ovaries : The ovaries are the primary sex organs of the female that lie in the lower part of the abdomen. The ovaries like the testes have both exocrine function that is production of ova and endocrine role that is secretion of female sex hormone, estrogen and progesterone.

(2) Fallopian tube (oviducts) : A fallopian tube is a long muscular tube. It conveys the egg from the ovary to the uterus and also provides the appropriate environment for its fertilization.

(3) Uterus : The uterus is a large, highly elastic sac specialized for the development of the embryo. The two oviducts unite to open into uterus. The uterus open into the vagina through the cervix.

(4) Vagina : It is large, elastic, muscular tube. It is adapted for receiving the semen during copulation, allowing menstrual flow and serving as birth canal during parturition.

OR

(i) **Various methods of contraception are :**

(a) Natural method

Intercourse is safe for a week before and week after menstruation.

(b) Mechanical methods (any one example)

(1) It includes use of condoms which are the rubber or plastic sheets put on the penis before coital activity.

(2) Use of diaphragms or cervical caps fitted in vagina of female to check the entry of sperms into the uterus and also helps in avoiding conception.

(3) Use of IUCD i.e., Intra Uterine Contraceptive Devices like copper T and loops fitted in the uterus, help to prevent fertilization and implantation of embryo. They can cause side effects due to irritation or infection of uterus.

(c) Chemical methods (any one example)

(1) It consists of using some chemicals which are spermicidal. They may be in form of tablets, jellies, paste and creams introduced in the vagina before coital activity.

(2) Another chemical method is the use of oral contraceptive (OC) pills which inhibit the secretion of FSH (Follicle Stimulating Hormone) and LH (Leutinising Hormone) from the anterior lobe of pituitary gland and thus inhibiting ovulation from the ovary. These contraceptive therefore change the hormonal balance so that egg cell are not released and hence prevent fertilization.

(d) Surgical methods (any one example)

(1) Tubectomy involves cutting of fallopian tubes in females and Vasectomy involves cutting of vas deferens of each side in males.

(2) Surgical removal of ovaries is known as ovariectomy and removal of testes is known as castration.

(3) Another surgical method is MTP i.e. Medical Termination of Pregnancy or abortion.

(4) Other method is tubal ligation in which fallopian tubes are blocked by an instrument called laproscope.

(ii) Sexually Transmitted Diseases (STDs) are infectious diseases which are spread by sexual contact, e.g. AIDS, Hepatitis, genital warts etc. (any two examples)

36. (a) The phenomena of bending of light ray, when it passes from an optically rarer medium to an optically denser medium or the other way round, is termed as refraction.

(b) Letters written on paper, when seen through a rectangular glass slab appears to be raised from their original position because of the phenomena of refraction of light. Light rays on passing from optically rarer medium to optically denser medium i.e., from air to the glass, bends toward the normal, and finally to reach our eyes, the light rays travel from glass to air where it bends away from the normal and thus, the letters seem to be raised.

Eye

Glass slab

x'

x
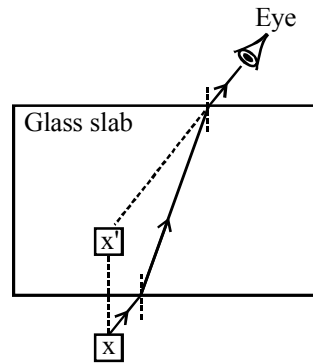
(c) Refractive index of diamond, $n_d = 2.42$

Speed of light in liquid $= 1.5 \times 10^8$ m/s

Refractive index of liquid,

$$n_\ell = \frac{\text{Speed of light in air}}{\text{Speed of light in liquid}} = \frac{3 \times 10^8}{1.5 \times 10^8} = 2$$

Refractive index of diamond with respect to liquid,

$$_\ell n_d = \frac{\text{Refractive index of diamond}(n_d)}{\text{Refractive index of liquid}(n_\ell)} = \frac{2.42}{2} = 1.21$$