1. **(a)** takes place in yeast during fermentation
   Explanation:
   takes place in yeast during fermentation

2. **(a)** Tt and Tt
   Explanation:
   Tt and Tt

3.
   (b) Lakes and gardens
   Explanation:
   Lakes and gardens

4.
   (c) (i) - (d), (ii) - (a), (iii) - (c), (iv) - (b)
   Explanation:
   - It is a condition of severely stunted physical and mental growth owing to untreated congenital deficiency of thyroid hormone.
   - Gigantism is a rare condition that causes abnormal growth in children caused by growth hormones.
   - Protrusion of the eyeball from the orbit, caused by disease, especially hyperthyroidism, or injury.
   - A disorder of salt and water metabolism marked by intense thirst and heavy urination.

5.
   (b) Plants $\rightarrow$ Man
   Explanation:
   Plants $\rightarrow$ Man

6. **(a)** Pepsin
   Explanation:
   Pepsin

7.
   (c) Cerebellum
   Explanation:
   Cerebellum

8. **(a)** Both A and R are true and R is the correct explanation of A.
   Explanation:
   Both A and R are true and R is the correct explanation of A.

9.
   (b) Both A and R are true but R is not the correct explanation of A.
   Explanation:
   Both A and R are true but R is not the correct explanation of A.

10. i. Protects the seed
    ii. Food storage area of the seed/reserve food material
    iii. Develops into root on germination of seed/future root

iv. Develops into shoot on germination of seed/future shoot

11. a. Grass → Insect → Frog → Snake → Hawk

   b. Third trophic level - Frog

   c. Hawk

   d. Biomagnification

   e. 1000J

<center>OR</center>

Changes within the packaging of assorted items lead to more waste as people throw them within the open environment carelessly. Reusing plastic containers and polythene bags for other purposes can help reduce non-biodegradable waste. Jute or paper bags can even be used rather than polythene bags.

12.
   - Movement of voluntary muscles (walking, writing)
   - Thinking
   - Hearing
   - Sight

13. a. Dominant trait - free earlobe: F f

   Recessive trait - Attached earlobe: ff.

50%   50%

Progeny- Ff :   ff
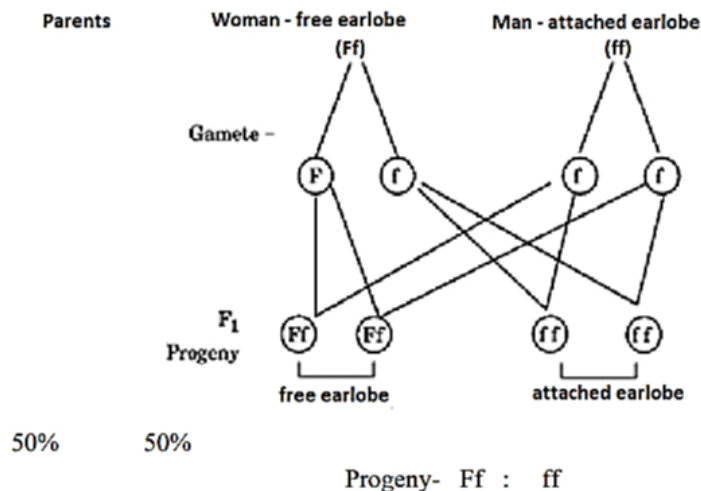
   b. Gene combinations of:

   Father - 'ff'

   Mother - 'Ff'

14. a.
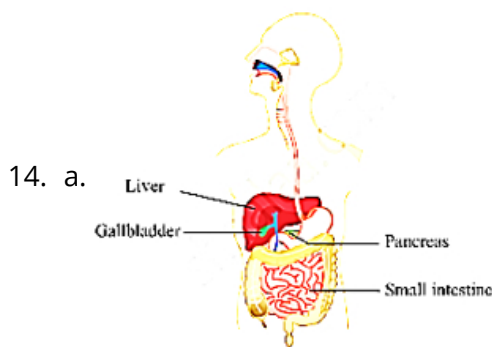
   b. The absorption of digested food primarily occurs in the small intestine because of the following reasons:
   - The finger-like projection of mucosa into the lumen of the small intestine is called villi which in turn serves to increase the surface area to facilitate maximum absorption of digested food.
   - The Wall of the small intestine is richly supplied with blood vessels that take the absorbed food to the different body parts.
   - **Large Surface Area:** The small intestine has a highly folded surface covered with finger-like projections called villi and microvilli. These structures greatly increase the surface area available for absorption. As a result, the small intestine can efficiently absorb nutrients, such as carbohydrates, proteins, fats, vitamins, and minerals, into the bloodstream.

15. i. The traits which do not show their characteristics in the presence of dominant genes are called recessive traits. OR The traits which are not often expressed and commonly observed are called

recessive traits.

  ii. The F_1 progeny of a tall plant with round seed (TTRR) and a short plant with wrinkled seed (ttrr) would be Tall plant with round seeds (TtRr).

  iii. When F1 progeny (TtRr) are cross-bred by self pollination, then four types of progeny are produced in F2 generation. Out of these four types of progeny, two types will have traits like parents and the other two will have combination of traits. Thus,

    a. Progeny with tall plants and round seeds- 9

    b. Progeny with tall plants and wrinkled seeds- 3

    c. Progeny with short plants and round seeds- 3

    d. Progeny with short plants and wrinkled seeds- 1

    Thus, the phenotypic ratio in F2 generation will be- 9 : 3 : 3 : 1

    OR

    The F_2 progeny would be having 9:3:3:1 phenotypic ratio. So, if 1600 plants were obtained,

    9 : 3 : 3 : 1 = 16

    $= \frac{1600}{16} = 100$

    So, 9 = 9 $\times$ 100 = 900 = Tall with round seeds.

    3 = 3 $\times$ 100 = 300 = Tall with wrinkled seeds.

    3 = 3 $\times$ 100 = 300 = short with round seeds.

    1 = 1 $\times$ 100 = 100 = short with wrinkled seeds.

16. i. **Two mode of asexual reproduction in hydra-Regeneration:** Many fully differentiated organisms have the ability to give rise to new individual organisms from their body parts. That is, if the individual is somehow cut or broken up into many pieces, many of these pieces grow into separate individuals. Regeneration is carried out by specialised cells. These cells proliferate and make large numbers of cells.

  Budding: Organisms such as Hydra use regenerative cells for reproduction in the process of budding. In Hydra, a bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and when fully mature, detach from the parent body and become new independent individuals.

  ii. Vegetative propagation is a process in which any vegetative part of a plant root stem or leaf gives rise to a new plant under appropriate conditions.

  Two advantages:

    a. Large number of plants obtained in a short interval.

    b. Propagation of seedless plants is made possible.

<div align="center">OR</div>

 i. Hormones are the chemical substances that regulate the biological processes in the living organisms. Characteristics of Hormones

    a. They are poured directly into the bloodstream in very small amounts and are carried throughout the body by circulatory system.

    b. They act only on the specific target organs.

  ii. a. Testosterone(produced by testes) is the hormone which brings the change in the male during adolescence.

    b. Insulin (decrease blood sugar) and glucagon (increase blood sugar), secreted by pancreas coordinates the sugar level in blood.

<div align="center">

Section B

</div>

17.

  (d) Statement (A)

  Explanation:

  The human stomach produces gastric juices which contain hydrochloric acid in them resulting in a pH of 1.4.
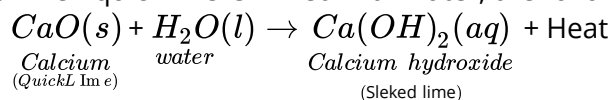
18.

(d) Both the statements A and B are true.

Explanation:

The freezing point of ethanoic acid is 17° C (290 K). When ethanoic acid (acetic acid) is cooled, it freezes to form a colourless, ice-like solid. The solid looks like a glacier and hence pure ethanoic acid are also called glacial ethanoic acid (or glacial acetic acid).

19.

(b) Magnesium is below calcium but above aluminium

Explanation:

Magnesium is below calcium but above aluminium

20.

(b) (i) - (a), (ii) - (c), (iii) - (b), (iv) - (d)

Explanation:

- Hydrogenation is an addition reaction. The addition of hydrogen to an unsaturated hydrocarbon to obtain a saturated hydrocarbon is called hydrogenation.
- Carbon tetrachloride is a product of a substitution reaction - a characteristic property of saturated hydrocarbons.
- Alcohol meant for industrial purposes is made unfit for human consumption by adding small amounts (about 5%) of methanol to alcohol. The mixture is known as denatured spirit or denatured alcohol.
- Ethyl ethanoate is a product of esterification.
  $CH_3COOH + C_2H_5OH \rightarrow CH_5COOC_2H_5 + H_2O$

21. **(a)** Action of steam on a metal

Explanation:

Action of steam on a metal.

22.

(c) Butyne C_4H_6

Explanation:

Butyne C_4H_6

23. **(a)** Gypsum

Explanation:

Gypsum

24.

(d) A is false but R is true.

Explanation:

During electrolysis of a concentrated aqueous solution of sodium chloride. Ions get attracted to oppositely charged electrodes, sodium is produced at the anode and chlorine gas is produced at the cathode.

25.
- Salt **X** is sodium bicarbonate or baking soda ($NaHCO_3$).
- Salt **Y** is sodium carbonate (Na_2CO_3) which is obtained when baking soda is heated.
- Gas **Z** is carbon dioxide (CO_2) which is obtained by heating baking soda and turns lime water milky.

26. a. $2\ Pb(NO_3)_2 \xrightarrow{\text{heat}} 2PbO + 4NO_2 + O_2$

b. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O +$ Heat + light

OR

i. The substance whose solution in water is used for white washing is calcium oxide. Its formula is **CaO**.

ii. When quicklime is mixed with water, the following reaction takes place:

$$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq) \text{ + Heat}$$

$$\underset{\substack{Calcium \\ (QuickL\,Im\,e)}}{} \quad \underset{water}{} \quad \underset{\substack{Calcium\ hydroxide \\ \text{(Sleked lime)}}}{}$$

27. C displaces B from its oxide, therefore, C is more reactive than B.

There is no reaction when C is treated with oxide of A or C does not displace A from its oxide. So, A is more reactive than C. Thus, the reactivity order is B< C< A.

28. i. **The oxidation and reduction occurring together** are called a redox reaction. CuO + H$_2$ $\longrightarrow$ Cu + H$_2$O. Example: In this reaction, copper oxide is being reduced to copper whereas hydrogen is being oxidised to water.

ii. Oxidising agents give oxygen to or removes hydrogen from other substances. The reducing agent undergoes loss of electrons. A reducing agent (also called a reductant or reducer) is an element or compound that loses (or "donates") an electron to another chemical species in a redox chemical reaction.

iii. ZnO is being reduced
ZnO is reduced to Zn and CO is oxidised to CO$_2$

OR

H$_2$O$_2$ is reduced to water by removal of oxygen.

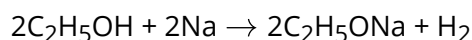29. The chemical formula is C$_2$H$_5$OH.

The name of the compound which is the active ingredient of all alcoholic drinks is Ethanol or Ethyl alcohol.
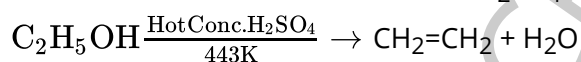
Its two uses are:

(i) It is a good solvent

(ii) It is used in medicines.

a. When ethanol reacts with sodium metal, sodium ethoxide is formed. The reaction is:
2C$_2$H$_5$OH + 2Na $\rightarrow$ 2C$_2$H$_5$ONa + H$_2$

b. When ethanol reacts with hot conc. H$_2$SO$_4$, ethene is formed. The reaction is:

$$\mathrm{C_2H_5OH} \xrightarrow[\mathrm{443K}]{\mathrm{HotConc.H_2SO_4}} \text{CH}_2\text{=CH}_2 + \text{H}_2\text{O}$$

OR

i. $A =$ Ethanol/Ethyl alcohol/C_2H_5OH
$B =$ Ethanoic acid/Acetic acid/CH_3COOH
$C =$ Ethene/C_2H_4/$CH_2 = CH_2$
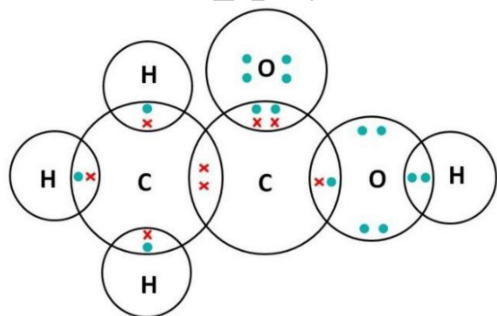
ii. Molecular mass of ethene (C_2H_4)
$12 \times 2 + 1 \times 4 = 24 + 4 = 28u$

iii. Brisk effervescence is observed.
$CH_3COOH + Na_2CO_3 \rightarrow CH_3COONa + H_2O + CO_2$
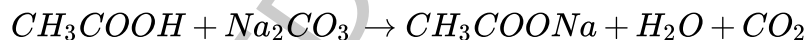
iv. (Ethanoic acid)

Section C

30.

(b) B and C

Explanation:

A ray of light passing from an optically denser medium to an optically rarer medium bends away from the normal, and a ray of light passing from an optically rarer medium to an optically denser medium bends toward the normal.

31.

(d) $\angle A$ and $\angle i$
Explanation:
$\angle A$ and $\angle i$

32.

(c) A is true but R is false.
Explanation:
Assertion is correct but the reason is wrong. As the current changes in the conductor, magnitude of the magnetic field produced also vanes which is the reason for a change in the deflection of the iron filings.

33. The conditions for observing a rainbow are:
  i. The sun comes out after a rainfall.
  ii. The observer stands with the sun towards His/her back.

Formation of a rainbow :

The rays of light reach the observer through a refraction, followed by a reflection and a refraction. Figure shows red light, from drop 1 and violet light from drop 2, reaching the observer's eye.

34. Given: R_1 = 10 Ω; R_2 = 20 Ω; R_3 = 30 Ω
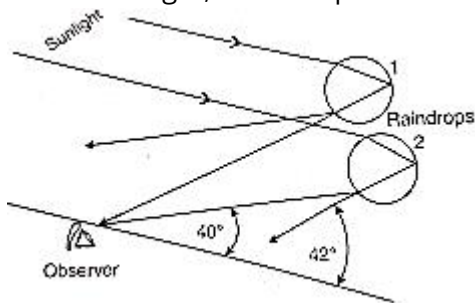
According to Ohm's law,
V = IR
Given V = 12 V

 a. Current through resistor R_1:

$$I_1 = \frac{V}{R_1} = \frac{12}{10} = 1.2 \text{ A}$$

Current through resistor R_2:

$$I_2 = \frac{V}{R_2} = \frac{12}{20} = 0.6 \text{ A}$$

Current through resistor R_3:

$$I_3 = \frac{V}{R_3} = \frac{12}{30} = 0.4 \text{ A}$$

 b. Total circuit resistance, R

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$
$$\frac{1}{R} = \frac{1}{10} + \frac{1}{20} + \frac{1}{30}$$
$$\frac{1}{R} = \frac{11}{60}$$
$$R = \frac{60}{11} = 5.45 \Omega$$

 c. The total current in the circuit is I = I_1 + I_2 + I_3

  = 1.2 + 0.6 + 0.4 = 2.2 A

OR

a. $X_1 = 3\ \Omega$; $X_2 = 3\ \Omega$

$\frac{1}{x_2} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$

Total resistance R = X_1 + X_2 = 3 Ω + 3 Ω = 6 Ω

b. Current through ammeter A, $I = \frac{V}{R} = \frac{6V}{6\Omega} = 1\ A$

c. Potential difference across 3 Ω = 1A $\times$ 3 Ω = 3 V

Potential difference across $6\Omega = \frac{1}{2}\ A \times 6\Omega$ = 3 V

35. a. i. Imagine that you are holding a current-carrying straight conductor in your right hand such that the thumb points towards the direction of current. Then your fingers will wrap around the conductor in the direction of the field lines of the magnetic field. This is known as the right-hand thumb rule.
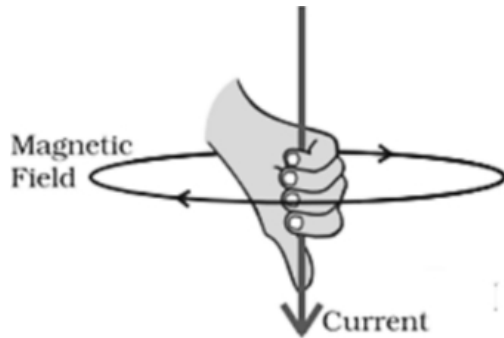
Note : Award full marks if explained diagrammatically.

ii. Stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular. If the first finger points in the direction of magnetic field and the second finger in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor.
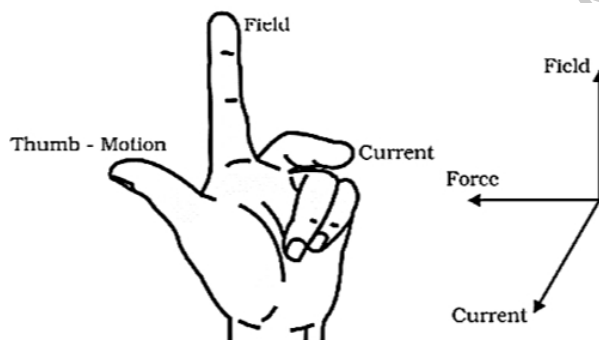
b. Out of plane of the paper

36. i. The eye suffering from myopia or short-sightedness, has long eyeball than that of normal eye due to which the retina is at a larger distance from the eye lens thus image formation occurs before retina rather than onto it.

ii. The eye suffering from hypermetropia or long-sightedness has short eyeball than that of normal eye due to which the retina is at smaller distance from the eye lens thus, the formation of the image occurs behind the retina and not on retina.
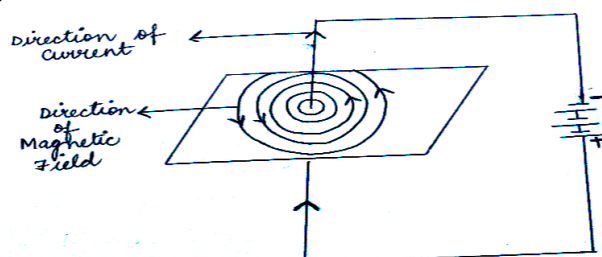
37. a.

Diagram Labelling of direction of current and corresponding field lines

b. i. Fleming's Left Hand Rule

ii. Out of the plane of paper

38. i. $\because$ Resistance in arms C are in series
So, Equivalent resistance of arm C
$R_C = 10 + 20 + 30$

$R_C = 60\Omega$

ii. Since resistance in arm B are in series
So, total resistance in arm B
$R_B = 5 + 10 + 15 = 30\Omega$

Now, Equivalent resistance of arm B and C
$\frac{1}{R} = \frac{1}{R_B} + \frac{1}{R_c}$
$\frac{1}{R} = \frac{1}{30} + \frac{1}{60}$
$\frac{1}{R} = \frac{2+1}{60} = \frac{3}{60}$
R = 20Ω

iii. Total resistance in arm A, as resistance are in series
$R_A = 5 + 15 + 20 = 40\Omega$

Equivalent resistance in circuit
$R_{eq} = R_A + R$

$R_{eq} = 40 + 20 = 60 \ \Omega$

By ohm's law,
V = IR
$I = \frac{V}{R} = \frac{6}{60}$ = 0.01 A

OR

If arm B is removed
Then total resistance of circuit
$R_{eq} = R_A + R_C$

$R_{eq} = 40 + 60 = 100\Omega$

By ohm's law
V = IR
$I = \frac{V}{R} = \frac{6}{100}$ = 0.06 A

39. i. The angle of incidence is equal to the angle of reflection.
The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.

ii. u = -15 cm, f = -10 cm (concave mirror)

h = 5.0 cm
Mirror formula $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$
$\frac{1}{v} = \frac{-1}{10 \text{ cm}} + \frac{1}{15 \text{ cm}} = \frac{-1}{30 \text{ cm}}$
or v = -30 cm. The screen must be placed at a distance of 30 cm from the mirror in front of it
$(m) = \frac{h'}{h} = -\frac{v}{u}$

$h = \frac{-\dot{v}}{u} \times h = -\frac{-30 \text{ cm}}{-15 \text{ cm}} \times 5 \text{ cm} = -10 \text{ cm}$

OR

Given,
f = 30cm
u = - 50 cm
h = 6cm
Lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{30} - \frac{1}{50}$$

$v = +75$ cm

$$m = \frac{v}{u} = \frac{h_i}{h}$$

$$\frac{75}{-50} = \frac{h_1}{6}$$

h_i = -9cm

The image formed is real, increased and enlarged.