CBSE
Class X Science

Time: 3 hrs   **Total Marks: 80**

General Instructions:
1. The question paper comprises of two **Sections, A** and **B**. You are to attempt both the sections.
2. All questions are compulsory.
3. All questions of **Section A** and **Section B** are to be attempted separately.
4. There is an internal choice in **three** questions of **three** marks each, **two** questions of **five** marks each in Section A and in **one** question of **two** marks in Section B.
5. Question numbers **1** and **2** in **Section A** are **one mark** questions. These are to be answered in one word or in **one** sentence.
6. Question numbers **3** to **5** in **Section A** are **two marks** questions. These are to be answered in about **30 words each**.
7. Question numbers **6** to **15** in **Section A** are **three marks** questions. These are to be answered in about **50 words each**.
8. Question numbers **16** to **21** in **Section A** are **five marks** questions. These are to be answered in about **70 words each**.
9. Question numbers **22** to **27** in **Section B** are based on practical skills. Each question is a **two** marks question. These are to be answered in brief.

Section A

1. Why are organisms formed by asexual reproduction considered clones?   (1)

2. Which of the following belong to the first trophic level?   (1)
   Grasshopper, rose plant, neem plant, cockroach, vulture

3. Why do ventricles have thicker walls than auricles?   (2)

4. An electric bulb is connected to a 220 V generator. The current flowing is 2 A. Find the power of the bulb and resistance of its filament.   (2)

5. How can the valency of an element be determined if its electronic configuration is known? What will be the valency of an element of atomic number 9?   (2)

6. A water-insoluble calcium compound A on reacting with dil. H_2SO_4 released a colourless and odourless gas B with brisk effervescence. When gas B was passed through lime water, the lime water turned milky and again formed compound A. Identify A and B, and write the chemical equations for the reactions involved.

7. Give reasons for the following: (3)
   (a) Diffusion is insufficient to meet the oxygen requirements of multicellular organisms.
   (b) People living in the mountains have more red corpuscles in their blood than people living in the plains.
   (c) Energy requirement is less for amphibians than for birds.

8. Complete the following equations:
   (a) $CH_4 + O_2 \rightarrow$
   (b) $C_2H_5OH \xrightarrow{\text{Hot conc. } H_2SO_4}$
   (c) $CH_3COOH + NaOH \rightarrow$ (3)

9. Why does a current-carrying solenoid, when suspended freely, rest along a particular direction? Explain. (3)

   OR

   Is it possible that a magnetic field be produced without using a magnet? Show that a magnetic field exerts a force on a current-carrying conductor with a suitable experiment.

10. Name and define the phenomenon due to which we observe a rainbow. Explain with a diagram and name the colour of light which bends (i) the most and (ii) the least while passing through a glass prism. (3)

11. An object is placed between infinity and the pole of a convex mirror. Draw a ray diagram and also state the position, the relative size and the nature of the image formed. (3)

12. Explain why: (3)
    (a) Digestion of food is a decomposition reaction.
    (b) All decomposition reactions are endothermic reactions.
    (c) A pop sound is produced when a burning candle is brought near the mouth of a test tube used in the electrolysis of water.

    OR

    (a) Soaps are not effective for washing woolen garments. Why?
    (b) Detergents are called 'soapless soaps'. Why?
    (c) Why is common salt added in the soap-making process?

13. Rahul complained of acidity on reaching home after a marriage. Explain the reason for acidity. (3)

OR

Most of the CO_2 produced in a tissue enters the red blood cells by diffusion. What happens to this CO_2?

14. If we cross a pure-bred tall (dominant) pea plant with a pure-bred dwarf (recessive) pea plant, we will obtain pea plants of the F_1 generation. If we now self-cross the pea plants of the F_1 generation, then we obtain pea plants of the F_2 generation. (3)
(a) What would the plants of the F_1 generation look like?
(b) State the ratio of tall plants to dwarf plants in the F_2 generation.
(c) State the type of plants not found in the F_1 generation but which appeared in the F_2 generation, mentioning the reason for the same.

15. Sanjeev, a marketing manager in an MNC, was not keeping well for a long time. He underwent a complete medical check-up and was diagnosed as HIV+. He was terminated on account of his condition. (3)
(a) To which category of diseases does AIDS belong? Give its causative organism.
(b) Do you think it was a right decision by the company to terminate Sanjeev?
(c) What concern should society show towards HIV+ individuals?

16. (5)
(a) Draw a diagram of the excretory unit of the human kidneys and label the following parts:
   Bowman's capsule, glomerulus, collecting duct, renal artery
(b) Write the important function of the structural and functional unit of the kidneys.
(c) Write any one function of an artificial kidney.

17. Which physical quantity indicates the degree of convergence or divergence of light rays passing through a lens?
One student uses a lens of focal length +75 cm and another of −75cm. Find the nature of each lens and find their powers. State which of the two lenses will always give a virtual, erect and diminished image irrespective of the position of the object. (5)

18. (a) What are amphoteric oxides? Give two examples. (5)
(b) Metals such as sodium and potassium are kept immersed in kerosene. Why?
(c) Give the balanced chemical equation for the reaction between aluminium and steam.
(d) Name a non-metal which is
   (i) Liquid at room temperature
   (ii) Lustrous

OR

(a) Name one metal each which is extracted by:
   (i) reduction with carbon
   (ii) electrolytic reduction
   (iii) reduction with aluminium
   (iv) reduction with heat alone

(b) Give reason for the following :
   Carbonate and sulphide ores are usually converted into oxides during the process of extraction of metals.

19.   [5]
(a) What is an electric circuit?
(b) Calculate the number of electrons that flow per second to constitute a current of one ampere. Charge on an electron is 1.6 x 10^{-19}C.
(c) Draw an electric circuit for studying Ohm's law. Label the circuit component used to measure electric current and potential difference.

OR

Study the following circuit and answer the questions that follow.
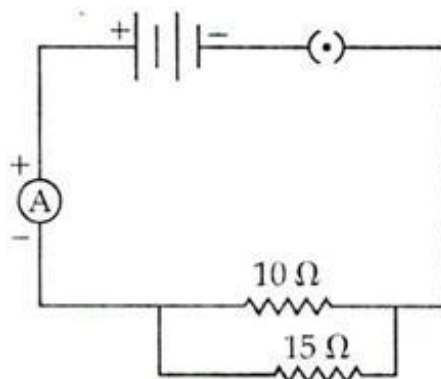
(a) State the type of combination of the two resistors in the circuit.
(b) How much current is flowing through the
 i. 10 ohm resistor
 ii. 15 ohm resistor
(c) What is the ammeter reading?
(d) Define the S.I. unit of current.

20.   (5)
(a) Why should we conserve our forests? List any two causes of deforestation.
(b) Prejudice against the traditional use of forest areas has no basis. Comment.

21. An organic compound 'C' molecular formula ($C_3H_6O_2$) reacts with sodium metal to form a compound 'R' and evolves a gas which burns with a pop sound. Compound 'C' on treatment with an alcohol 'A' in presence of an acid forms a sweet smelling compound 'S' (molecular formula [$C_4H_8O_2$]). On addition of NaOH to 'C', it also gives 'R' and water. 'S' on treatment with NaOH solution gives back 'R' and 'A'. Identify 'C', 'R', 'A', 'S' and write reactions involved. (5)

Section B

22. Observe the figure carefully. (2)
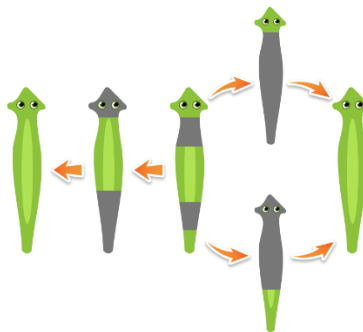
(a) Name the method of reproduction. What happens in this method?
(b) Give two examples of organisms which reproduce by this method.

23. How can potato plants be propagated faster—by sexual reproduction or by vegetative propagation? (2)

24. Write the balanced chemical equation for the chemical reaction between manganese dioxide and aluminium powder. What happens if manganese powder is heated with aluminium oxide? (2)

25. Complete the following reactions: (2)
    a) $Mg + HCl \rightarrow$
    b) $CaCO_3 + H_2SO_4 \rightarrow$
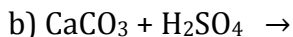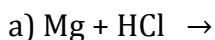
26. A simple circuit has its resistors connected in series. What will be the change in voltage and amount of current flowing through that circuit if a student rearranges and connects the resistors of that circuit in parallel? (2)

OR

In a voltmeter there are 20 divisions between the 0 mark and 0.5 V mark. What is the least count of the voltmeter?

27. Given that the refractive index of a glass slab is 1.5, four observations were made by tracing the path of a ray of light passing through it for an angle of incidence 40°. The observed measures of the angle of refraction were 18°, 22°, 25° and 30°, respectively. Which of these observations are correct? (2)

CBSE
Class X Science
Solution

Section A

1. Organisms produced by asexual reproduction contain exactly the same number of chromosomes as the parent cells. They resemble their parents in all the characteristics and hence are considered clones.

2. Rose and neem plants belong to the first trophic level as they both are producers and provide food to the entire food chain.

3. Ventricles have to pump blood to various organs of the body. As a result, the pressure of blood flowing in the ventricles is more than that in the auricles. Therefore, ventricles have thicker muscular walls than auricles.

4. Given:
   V = 220 V
   I = 2 A
   To calculate Power,
   P = VI
     = 220 × 2
   P = 440 W
   The power of the bulb is 440 W.
   To calculate Resistance,
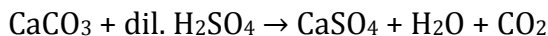 $R = \dfrac{V}{I}$
   $R = \dfrac{220}{2} = 110 \ \Omega$
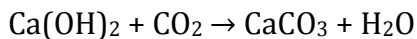   Resistance of the filament is 110Ω.

5. An element's valency is determined by the number of electrons in its outermost shell. Hence, the number of valence electrons obtained from the electronic configuration of the element gives its valency, i.e. the number of electrons lost, gained or shared by the element to attain the noble gas configuration.
   The valency of an element of atomic number 9 would be 1; because the number of valence electrons in its outermost shell is 7, it needs only one electron to attain the noble gas configuration.

6.

$CaCO_3$ + dil. $H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$
(water insoluble)
(A)   (B)
$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
(lime water)   (A)
                    Milky
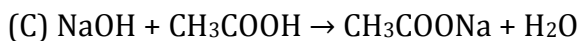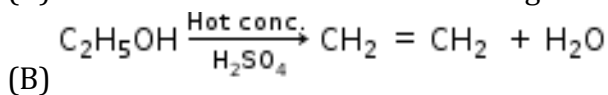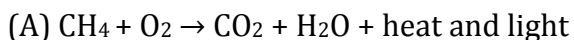
A - $CaCO_3$ (lime water)
B - $CO_{2(g)}$

7.

(a) Diffusion is insufficient to meet the oxygen requirements of multicellular organisms because the volume of the human body is so big that oxygen cannot diffuse into all the cells of the body quickly.

(a) People living in the mountains have more red corpuscles in their blood than people living in the plains because the low air pressure requires more red blood corpuscles to supply the body cells with oxygen.

(b) Amphibians are cold-blooded animals whose body temperature depends on the temperature in the environment. They do not need energy to maintain their body temperature, and hence, their requirement of energy is less.

8.

(A) $CH_4 + O_2 \rightarrow CO_2 + H_2O$ + heat and light

$C_2H_5OH \xrightarrow[\text{H}_2\text{SO}_4]{\text{Hot conc.}} CH_2 = CH_2 + H_2O$
(B)

(C) $NaOH + CH_3COOH \rightarrow CH_3COONa + H_2O$

9. A current-carrying solenoid behaves like a bar magnet. We know that a freely suspended bar magnet aligns itself in the north-south direction. So, a freely suspended current-carrying solenoid also aligns itself in the north-south direction.

OR

A magnetic field can be produced without a magnet by passing current through the conductor.

Experiment to show that a magnetic field exerts a force on a current-carrying conductor:
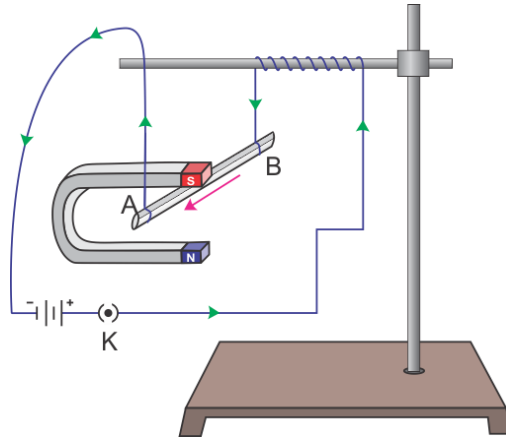

Consider a small aluminium rod suspended horizontally from a stand using two connecting wires. Place a strong horseshoe magnet in a way that the rod lies between the two poles with the magnetic field directed upwards. For this, put the North Pole of the magnet vertically below and the South Pole vertically above the aluminium rod. Connect the aluminium rod in series with a battery, a key and a rheostat. Pass a current through the aluminium rod from one end to the other (B to A). The rod is displaced towards the left. When the direction of current flowing through the rod is reversed, the displacement of the rod is towards the right. This experiment shows that a magnetic field exerts a force on a current-carrying conductor.

10. The phenomenon due to which we observe a rainbow is called dispersion of light. Splitting of white light into its constituent colours is called dispersion of white light.
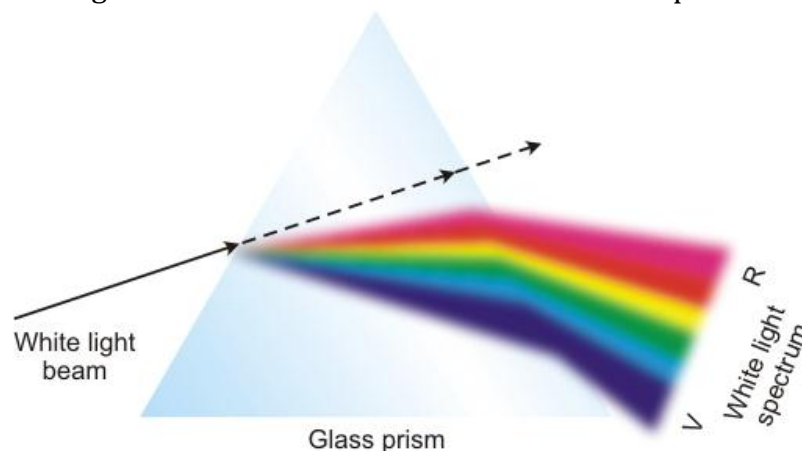
When light is passed through a glass prism, white light disperses into seven colours—violet, indigo, blue, green, yellow, orange and red.

Violet light bends the most, while red light bends the least.

11.
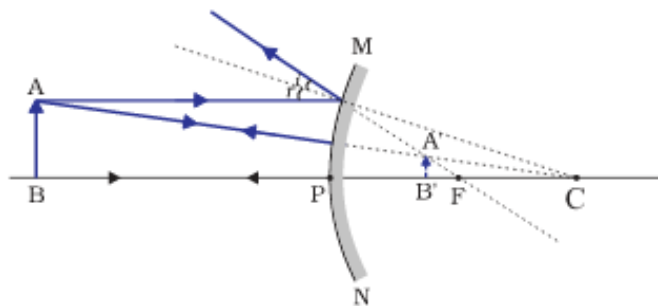
An object is placed between infinity and the pole of a convex mirror, the image formed is:

   i.   Behind the mirror at focus (F),

   ii.   Virtual and erect,

   iii.   Highly diminished

12.

(a) Digestion of food is a decomposition reaction. When we eat food such as wheat, rice or potato, the starch present in them decomposes to give simple sugars like glucose and the proteins break down to amino acids.

(b) Energy in the form of heat, light or electricity is required for decomposition reactions to occur; hence, these are endothermic.

(c) When a burning candle is brought near the mouth of a test tube containing hydrogen gas, hydrogen burns producing a pop sound.

OR

(a) Soaps, being basic in nature, react with the acidic dye of a woollen garment and hence are not effective for washing woollen garments.

(b) Detergents are called 'soapless soaps' because although they act like soaps with cleansing properties, they do not contain sodium stearate.

(c) Common salt is used in the soap-making process to precipitate out all the soap from the aqueous solution.

13. When we eat more food or spicy food, our digestive system has to work more by releasing more amount of enzymes for digestion. The stomach releases more HCl to digest more food because of which a lot of acid is formed, which may cause acidity. Acidity can also cause diarrhoea, i.e. vomiting and loose motions.

OR

Most of the CO_2 produced in a tissue enters the RBCs of blood by diffusion. RBCs consist of a pigment called haemoglobin. This pigment binds with CO_2 and gets transported to the lungs through blood from where it is released out through the nostrils.

14.

(a) In the F_1 generation, all the plants would be tall.

(b) Tall : Dwarf = 3 : 1.

(c) Dwarf plants are found in the F_1 generation but appear in the F_2 generation. This is because the trait for tallness is dominant over the trait for dwarfness.

15.

(a) AIDS belongs to the category of viral diseases. It is caused by a retrovirus called human immunodeficiency virus (HIV).

(b) No, it was not the right decision of the company to terminate Sanjeev because it is possible for any person to contract AIDS. We should not discourage people or isolate them just because they are suffering from AIDS. It is against human values.

(c) Society should show empathy, compassion and sensitivity towards people with HIV and AIDS.

16.

(a) Excretory unit of the human kidney
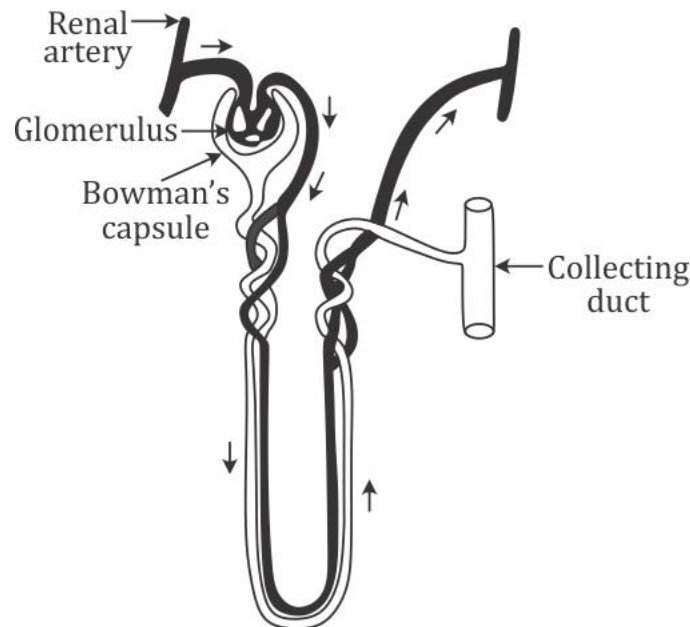
(b) The structural and functional unit of the kidneys is the nephron. Its function is filtration of blood, reabsorption and secretion.

(c) Function of an artificial kidney: (Any one)

- Helps to remove harmful wastes, extra salts and water
- Controls blood pressure
- Maintains the balance of sodium and potassium salts in a patient whose kidneys have failed

17. Power of a lens gives the degree of convergence or divergence of light rays achieved by the lens. It is the reciprocal of its focal length. It is represented by the letter P. Power P of a lens of focal length f is

$$P = \frac{1}{f\,(\text{in metres})}$$

Its SI unit is called dioptre, represented as D. One dioptre is the power of a lens with a focal length of 1 metre.

The focal length of the lens used by the first student is f = +75 cm. Hence, the lens is a convex lens. The focal length of the lens used by the second student is f = −75 cm. Hence, the lens is a concave lens.

Power of lens 1 is $P_1 = \dfrac{1}{75 \times 10^{-2}} = 1.33\ \text{D}$

Power of lens 2 is $P_2 = \dfrac{1}{-75 \times 10^{-2}} = -1.33\ \text{D}$

A concave lens always gives a virtual, erect and diminished image. Hence, the lens used by the second student is the one which will give such an image.
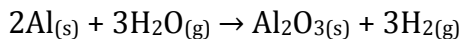
18. (a) Amphoteric oxides show properties of both acids and bases to form salt and water.
Examples: Aluminium oxide(Al_2O_3),zinc oxide (ZnO)
(b) Metals such as sodium and potassium are kept immersed in kerosene because they are very reactive, have high affinity towards oxygen and will violently react with atmospheric oxygen on contact with air.
(c) Aluminium reacts readily with steam to give aluminium oxide and hydrogen gas. The reaction does not always occur because of a thin but strong layer of aluminium oxide being coated onto the metal.
Aluminium + Steam → Aluminium oxide + Hydrogen
$2Al_{(s)} + 3H_2O_{(g)} \rightarrow Al_2O_{3(s)} + 3H_{2(g)}$
(d) (i) Non-metal which is a liquid at room temperature: Bromine
(ii) Non-metal which is lustrous: Iodine

OR

(a)
(i) Zinc
(ii) Sodium
(iii) Manganese
(iv) Mercury

(b) Carbonate and sulphide ores are usually converted into oxides because it is easier to obtain metals from their oxides (by reduction) than from carbonates or sulphides.

19.

(a)   A continuous conducting path consisting of wires and other resistances (like electric bulb, etc.) and a switch, between the two terminals of a cell or a battery along which an electric current flows, is called an electric circuit.
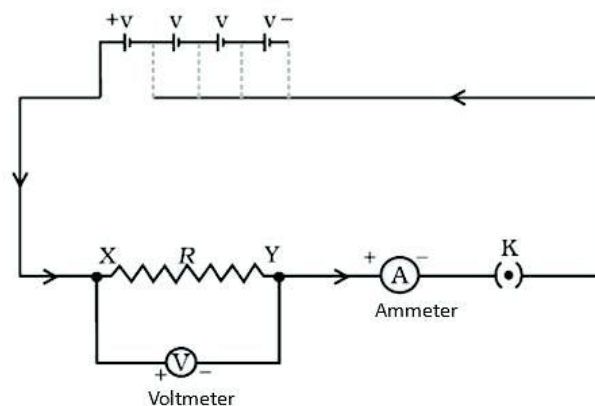
(b)   Given:

$I = 1$ A

$t = 1$ sec

$Q = 1$ C

1.6×10^{-19} C is the charge on 1 electron.

1 C is the charge on   electrons= (6.25×10^{18}) electrons.

6.25×10^{18} electrons flow per second to constitute current of one ampere.

(c)

Ammeter

Voltmeter

OR

(a) Parallel combination.

(b) Let V be the voltage applied.

i. Current flowing through 10 Ω resistor is

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

ii. Current flowing through 15 Ω resistor is

$$I_2 = \frac{V}{R_2} = \frac{V}{15} \text{ A}$$

(c) Equivalent resistance of the circuit, R is given as

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R} = \frac{1}{10} + \frac{1}{15}$$

$$\frac{1}{R} = \frac{1}{6}$$

$R = 6 \, \Omega$

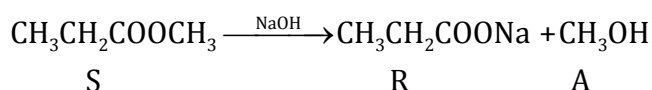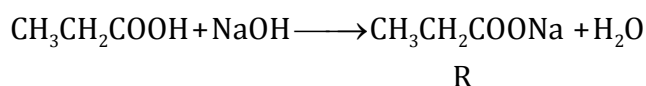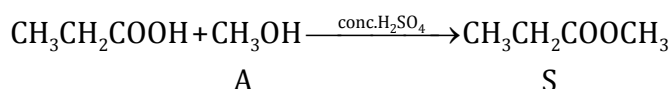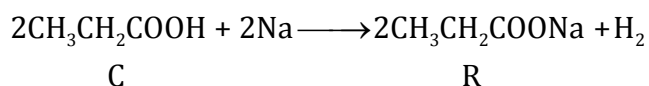Ammeter reading, $I = \dfrac{V}{R} = \dfrac{V}{6}$ A

20.

(a) Forests are renewable natural resources which are essential to maintain the ecological balance of the ecosystem. They maintain biological diversity, preserve foods and safeguard the future of tribals, besides providing valuable products for human welfare and raw materials for industries. Hence, it is important to conserve our forests.

Causes of deforestation:
- Indiscriminate felling of trees for the purpose of timber, fuel and industrial demand of wood
- Over-grazing by a large livestock population

(b) Prejudice against the traditional use of forest areas has no basis. This can be explained with the help of an example. The Great Himalayan Park contains alpine meadows which were grazed by sheep in summer. Nomadic shepherds drove their flocks up from the valley every summer. When the National Park was formed, this practice was banned. In the absence of grazing, the grass first grew very tall and then fell over on the ground preventing fresh growth. Hence, the traditional use was helpful for forest maintenance.

21.

$$2CH_3CH_2COOH + 2Na \longrightarrow 2CH_3CH_2COONa + H_2$$
$$\quad\quad\quad C \quad\quad\quad\quad\quad\quad\quad\quad\quad\quad R$$

$$CH_3CH_2COOH + CH_3OH \xrightarrow{\text{conc.}H_2SO_4} CH_3CH_2COOCH_3$$
$$\quad\quad\quad\quad\quad\quad A \quad\quad\quad\quad\quad\quad\quad\quad\quad S$$

$$CH_3CH_2COOH + NaOH \longrightarrow CH_3CH_2COONa + H_2O$$
$$\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad R$$

$$CH_3CH_2COOCH_3 \xrightarrow{\text{NaOH}} CH_3CH_2COONa + CH_3OH$$
$$\quad\quad S \quad\quad\quad\quad\quad\quad\quad R \quad\quad\quad\quad A$$

Section B

22.
   (a) The figure shows regeneration as a method of reproduction. In this method, organisms have the ability to replace lost or damaged body parts thus giving rise to new individuals.

   (b) Organisms which reproduce by regeneration: Starfish, lizard

23. Each potato plant produces more than one tuber and each tuber has more than one bud which gives rise to more than one new plant. As a result, the vegetative propagation method of producing potato plants by tubers is much faster than the sexual method of production of potato plants from seeds.

24. When aluminium powder is heated with manganese dioxide, the following reaction takes place:

$$3MnO_{2(s)} + 4Al_{(s)} \rightarrow 3Mn_{(l)} + 2Al_2O_{3(s)} + heat$$

When manganese powder is heated with aluminum oxide, no reaction takes place because manganese is less reactive than aluminium. Hence, there will be no displacement reaction.

25. a) $Mg + 2HCl \rightarrow MgCl_2 + H_2$

   b) $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

26. When resistors are connected in series, the equivalent resistance increases.
When resistors are connected in parallel, the equivalent resistance decreases.
Hence, the current shown by an ammeter in a series connection is less than that of a parallel connection.
So, $I_1 < I_2$.
The voltmeter in both connections however shows the same reading.

OR

$$\text{Least count} = \frac{0.5 - 0}{20} = 0.025 \text{ V}$$

Thus, the least count of voltmeter is 0.025 V.

27. The ratio of the angles of incidence and refraction is given by Snell's law:

$$\frac{\sin i}{\sin r} = \mu$$

For glass, $\mu = 1.5$

for r = 18°

$$\frac{\sin 40}{\sin 18} = 2.08 \neq 1.5$$

Thus, this observation is wrong

for r = 22°

$$\frac{\sin 40}{\sin 22} = 1.71 \neq 1.5$$

Thus, this observation is wrong

for r = 30°

$$\frac{\sin 40}{\sin 30} = 1.28 \neq 1.5$$

Thus this observation is wrong

for r = 25°

$$\frac{\sin 40}{\sin 25} = 1.5$$

Thus, the observation which measures the refracting angle as 25° is correct.