CBSE Board
Class X Science
Sample Paper - 5
Term 2 – 2021-22

Time: 2 hours   **Total Marks: 40**

General Instructions:
  i. *All questions are compulsory.*
  ii. *The question paper has three sections **and 15 questions**. All questions are compulsory.*
  iii. *Section–A has 7 questions of 2 marks each; Section–B has 6 questions of 3 marks each; and*
  Section–C has 2 case-based questions of 4 marks each.
  iv. *Internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.*

SECTION-A

1. Specify the events which occur in the reproductive system of a human female.[2]
   (i) if egg is fertilised
   (ii) if egg is not fertilised.

2. In a tobacco plant, the male gametes have 24 chromosomes. What is the number of chromosomes in the female gamete? What is the number of chromosomes in the zygote? [2]

3. Give a test that can be used to confirm the presence of carbon in a compound. With a valency of 4, how is carbon able to attain noble gas configuration in its compounds? [2]

4. The number of carbon compounds is more than those formed by all other elements put together. Justify the statement by giving two reasons. [2]

5. Neha took two bread slices and kept them in the following conditions: [2]
   (a) Slice 1 in a dried and dark place
   (b) Slice 2 in moist and dark place
   What would she observe in each of the above conditions?
   <div align="center">**OR**</div>
   Kashyap noticed that an organism by mistake was cut into parts. After sometime, both parts developed into new individuals.
   (a) Name the mode of reproduction used by the organism.
   (b) State the type of cells which carry out this process.
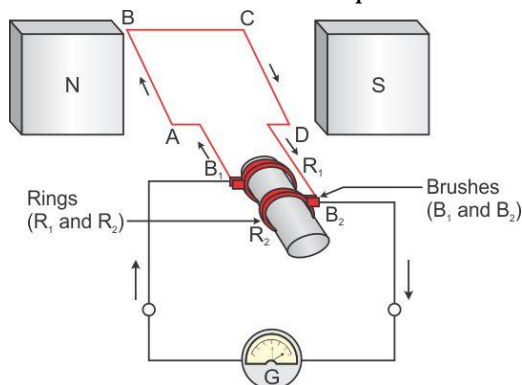
6. The diagram below shows a bar magnet surrounded by two compasses numbered 2 and 4. What directions will these compasses show? [2]
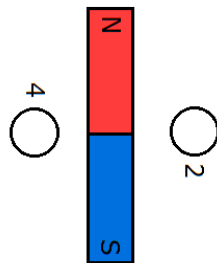
OR

Observe the diagram given below and answer the questions based on it.

a) What does above diagram represent?
b) On which principle the above device works?

7. Our food grains such as wheat and rice, vegetables and fruits, and even meat are found to contain varying amounts of pesticide residues. State the reason to explain how and why it happens? [2]

OR

Make food chains in (i) forest (ii) grassland. How does food chain differ from a food web?

SECTION – B

8. [3]
(a) State the Modern Periodic Law. How have the elements been arranged in the modern periodic table?
(b) Why is the position of hydrogen in the periodic table considered anomalous?

OR

An element X (2, 8, 2) combines separately with NO3- and $(PO_4)^{3-}$ radicals. Write the formulae of the compounds so formed. To which group of the periodic table does the element 'X' belong? Will it form covalent or ionic compounds with these radicals? How?

9. A quiz contest was being held in the school for chemistry students. The quiz-master said:
   An element has the electronic configuration 2, 8, 2. [3]
   (a) What is the atomic number of this element?
   (b) Is it a metal, non-metal or metalloid?
   (c) Which of the elements Mg, O, P or Ar shows similarity with this element? [3]

10. In a monohybrid cross between tall pea plants denoted by TT and dwarf pea plants denoted by tt, Suman obtained only tall plants denoted by Tt in the F_1 generation. However, in F_2 generation she obtained both tall and short pea plants. Using the above information, explain the law of dominance. [3]

11. A 4 kW heater is connected to a 220-V power source. Calculate
    i.   Electric current passing through the heater
    ii.   Resistance of the heater
    iii. Electric energy consumed in a 2-hour use of the heater [3]

12. In the circuit given below, three resistors of 5 Ω, 10 Ω and 20 Ω, respectively, are connected across a battery of 12 V. [3]
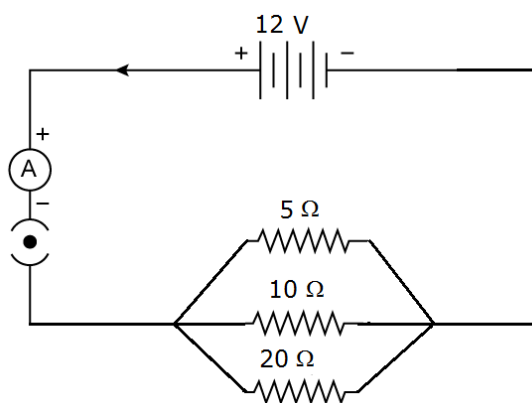
   Calculate:
   (a) Current through each resistor
   (b) Total current in the circuit
   (c) Total resistance of the circuit

                              OR

   An electrical appliance is rated 200 V–100 W. What is the resistance of the appliance? Five such appliances run simultaneously for 4 hours. What is the energy consumed? Calculate the cost of running these appliances if the per unit cost is Rs 4.60.

13. The Government of Delhi has proposed the odd-even formula for the use of cars on an alternate basis. The move is aimed at reducing the level of pollution in the city. Further, this move will also help in the conservation of fuel resources. [3]
    (a) How can such a move help in conservation of fuel resources?
    (b) How can we ensure lesser emission of pollutants from the vehicles? (Any two points).
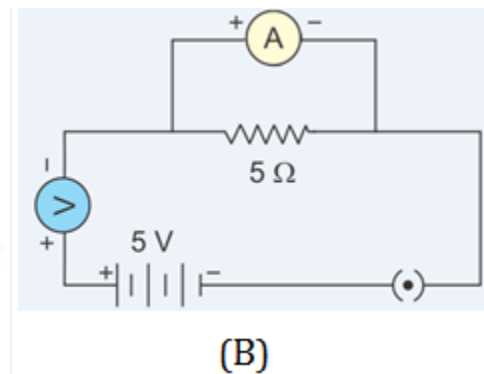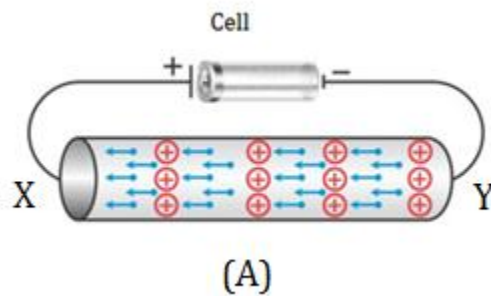
SECTION – C

This section has 02 case-based questions (14 and 15). Each case is followed by 03 sub-questions (a, b and c). Parts a and b are compulsory. However, an internal choice has been provided in part c.

14. In a cross between plants with purple flowers and plants with white flowers, the F_1 generation had all purple flowers. When F_1 generation was self-bred, the F_2 generation gave rise to 100 individuals, 75 of which had purple flowers. Make a cross and answer.
 a) What is the ratio of purple flowered plants in F_2 generation? (1)
 b) What are the genotypes of F_2 individuals? (1)
 c) If F_2 generation gave rise to 400 individuals, how many flowers would be pure homozygous? Give the genotype of these plants. (2)

OR

Instead of the above cross, if there was a cross between tall and dwarf plants resulting in 100 individuals in F_2 generation, how many plants would have been dwarf? Give reason for your answer.

15. Observe the diagrams (A) and (B) and answer the questions from (a) to (c) on the basis of related studied concepts.

(A)   (B)

 a) State the direction of current in metal wire XY. (1)
 b) What happens when the cell across the metal wire XY is removed? (1)
 c) Which devices are connected incorrectly in circuit diagram 15(B)? Why? (2)

OR

Draw the correct circuit diagram for replacing the incorrect circuit connections.

Solution

SECTION-A

1. (i) If egg is fertilized, it gets implanted in the uterine lining resulting in pregnancy.
   (ii) If egg is not fertilized, it is shed out of the body along with blood causing menstruation.

2. Number of chromosomes in female gamete is 24.
   Number of chromosomes in zygote is 48.

3. Burn compound in air/ oxygen; Gas evolved turns lime water milky
   By sharing its four valence electrons with other elements.

4. (i) Due to self-linking ability of carbon/catenation since carbon has a valency of four it can form bonds with four other atoms of carbon or atoms of some other mono-valent element.
   (ii) Due to small size of carbon it forms very strong and (or) stable bonds with other elements.

5. (a) No spores will be formed in Slice 1 due to lack of moisture.
   (b) In Slice 2, fungal hyphae develop as white cottony mass and bear sporangia having spores due to the presence of favourable conditions of moisture and darkness.

   OR

   (a) The mode of reproduction used by the organism is regeneration.
   (b) It is carried out by specialised cells called regenerative cells which can proliferate and make a large number of cells by cell division.

6. Directions shown by the needle of compasses 2 and 4 would be as shown below.
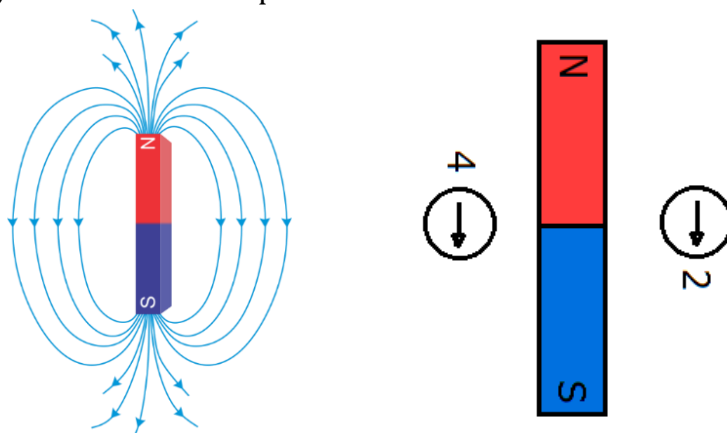
   This is because the magnetic field lines arise from the North Pole and end at the South Pole.

Hence, the needle of compasses 2 and 4 will be aligned along the magnetic field lines directed downwards.

OR

a) The diagram given in the question represents electric generator.
b) Electric generator works on Faraday's law of electromagnetic induction.

7. Harmful pesticides like DDT enter the plant body on being absorbed from the soil. When these are eaten by animals they get accumulated in the animal's body as they are neither metabolized nor excreted out of their body. The concentration of these harmful chemicals gets increased at successive levels and are thus found in food grains as well as meat.

OR

The food chains are as follows:
(i) Forest: Plants → Deer → Lion
(ii) Grassland: Plants → Grasshopper → Frog → Snake → Eagle
Food chain is a series of organisms feeding on one another while the food web is a network of food chains consisting of a number of interlinked food chains.
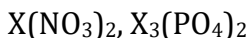
SECTION - B

8.
(a) The modern periodic law states that the properties of elements are periodic functions of their atomic numbers.
The arrangement of elements in the modern periodic table is based on their electronic configuration. The elements are arranged in the order of increasing atomic numbers.
(b) In increasing order of atomic number, hydrogen can be placed in Group 1 with alkali metals as well as with halogens in Group 17. Hence, its position is anomalous.

OR

Two compounds formed:
$X(NO_3)_2$, $X_3(PO_4)_2$
X belongs to Group 2.
X will form ionic compounds because it is a metal, and the radicals are of non-metals.

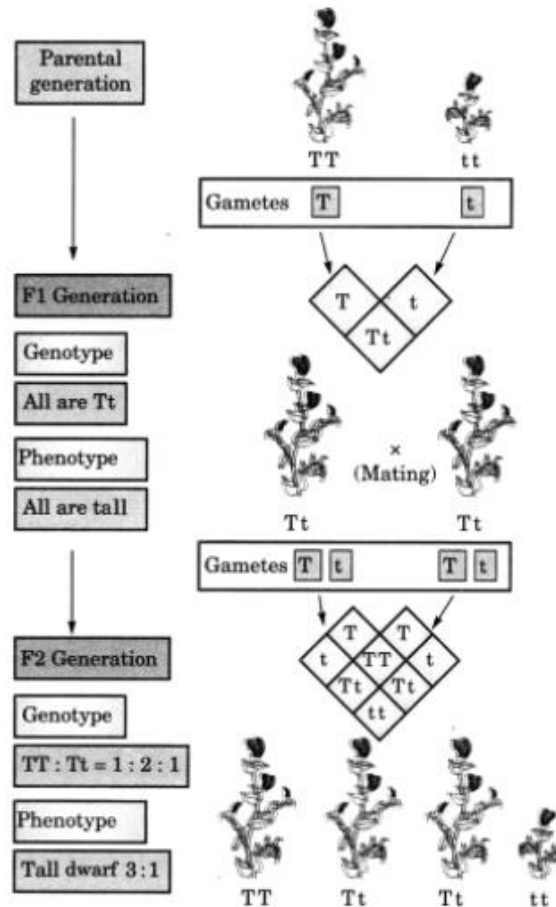9. From the electronic configuration, it is clear that the compound is calcium (Ca).
(a) Atomic number: 12
(b) Calcium is a metal.
(c) Mg, as it belongs to the same group as the element calcium.

10. The cross shown below demonstrates that the traits may be dominant or recessive.

The law related to it is the Mendel's first law of inheritance i.e., Law of dominance, which states that:
- Characters are controlled by discrete units called factors.
- Factors occur in pairs.
- In a dissimilar pair of factors one member of the pair dominates (dominant), the other is submissive (recessive).

11.
Power rating of the heater, P = 4 kW = 4000 W
Potential difference of the power supply, V = 220 V
(i) Power is
$$P = VI$$
$$\therefore I = \frac{P}{V} = \frac{4000}{220} = 18.18 \text{ A}$$
(ii) Resistance and power are related as
$$P = \frac{V^2}{R}$$
$$\therefore R = \frac{V^2}{P} = \frac{220^2}{4000} = 12.1 \ \Omega$$

(iii) Energy consumed by the heater is

$E = Pt$

$\therefore E = 4 \text{ kW} \times 2\text{h}$

$\therefore E = 8 \text{ kWh}$

12.

a) As the resistors are connected in parallel, the voltage across each resistor is the same. Hence, current through each resistor is

$I_5 = \dfrac{V}{5} = \dfrac{12}{5} = 2.4 \text{ A}$

$I_{10} = \dfrac{V}{10} = \dfrac{12}{10} = 1.2 \text{ A}$

$I_{20} = \dfrac{V}{20} = \dfrac{12}{20} = 0.6 \text{ A}$

b) Total current in the circuit is

$I = I_5 + I_{10} + I_{20}$

$\therefore I = 2.4 + 1.2 + 0.6$

$\therefore I = 4.2 \text{ A}$

c) Total resistance in the circuit is

$V = IR_{eq}$

$\therefore R_{eq} = \dfrac{V}{I} = \dfrac{12}{4.2}$

$\therefore R_{eq} = 2.85 \ \Omega$

OR

Rating of the electrical appliance is 200 V–100 W.

Therefore, the resistance of the appliance is

$P = \dfrac{V^2}{R}$

$\therefore R = \dfrac{V^2}{P} = \dfrac{200^2}{100}$

$\therefore R = 400 \ \Omega$

Total power consumed by 5 bulbs will be 500 W.

Hence, for a four hour, the energy consumed is

$E = Pt$

$\therefore E = 500 \times 4 = 2000 \text{ Wh} = 2 \text{ kWh}$

Cost of electricity per unit is Rs 4.60.

Hence, the total cost is

$\text{Cost} = 2 \times 4.60 = \text{Rs. } 9.2$

13.

(a) The vehicles usually run on petrol and diesel which are non-renewable energy resources. The odd-even formula for the use of cars on an alternate basis will help in the conservation of valuable fossil fuels such as petrol and diesel.

(b) We can ensure lesser emission of pollutants from the vehicles in the following ways:
- Strict pollution control norms.
- Better engines with higher fuel efficiency.
- Ensuring lesser emissions of exhaust gases from vehicles.
- Use of cleaner fuels like CNG.

SECTION – C

14. The cross is depicted as under:

W = White, w = purple
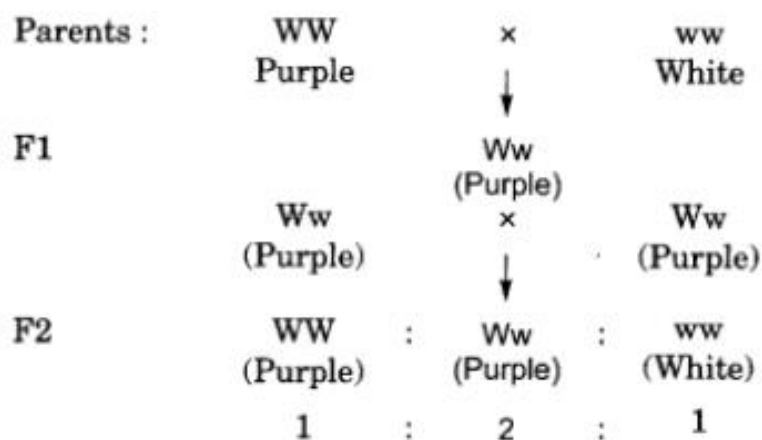
a) Ratio of purple flowered plants in F_2 generation is:
   Purple : White = 3 : 1
b) The genotype of F_2 individuals is:
   WW (Purple) : Ww (Purple) : ww (White) = 1 : 2 : 1
c) Homozygous is a genetic condition where an individual inherits the same alleles for a particular gene from both parents.
   In the above cross, the pure homozygous individuals have the genotype WW (Purple) and ww (White). So, if there are 400 individuals obtained in the F_2 generation, then there would be 100 individuals each with genotype WW and ww. Thus, there would be a total of 200 flowers which are pure homozygous.

OR

The cross is depicted as under:
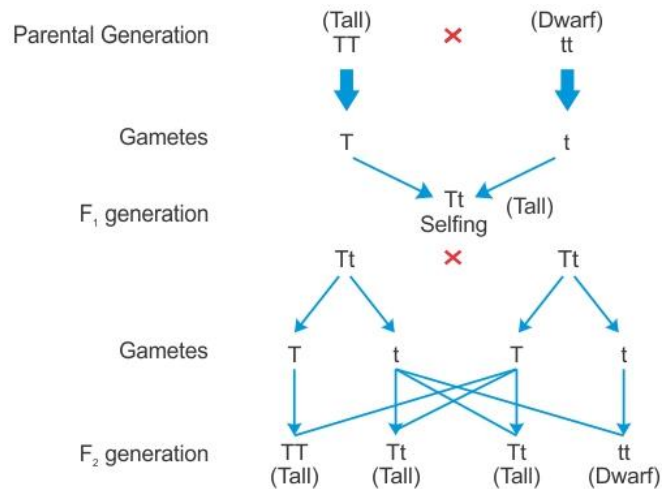
With respect to height of the plant, the trait for tallness is dominant over trait for dwarfness. Thus, the phenotypic ratio of tall and dwarf plants in F_2 generation would be 3 : 1. Hence, out of 100 individuals, 25 individuals would have been dwarf and 75 would have been tall.

15.
   a) As the direction of electrons is from Y to X, the direction of the current will be from X to Y in the circuit.
   b) When the cell is not connected across the metal wire XY, the electrons in the wire XY flow randomly in all directions.
   c) The voltmeter and ammeter are incorrectly connected in the circuit. The voltmeter should be connected across the resistor to measure the PD across the conductor, and the ammeter must be connected in series with the resistor to measure the current flowing through it.

OR