Time: 2 Hrs.   # Class-X   **Max. Marks: 40**

SCIENCE (Theory) Term-II
(CBSE 2022)

GENERAL INSTRUCTIONS

Read the following instructions carefully and strictly follow them:

(i)   *This question paper contains **15** questions. **All** questions are compulsory.*

(ii)   *This question paper is divided into **three** Sections viz. Section **A, B** and **C**.*

(iii)   *Section **A** – Question numbers **1** to **7** are short answer type questions. Each question carries **two** marks.*

(iv)   *Section **B** – Question numbers **8** to **13** are also short answer type questions. Each question carries **three** marks.*

(v)   *Section **C** – Question numbers **14** and **15** are case based questions. Each question carries **four** marks.*

(vi)   *Internal choices have been provided in some questions. Only one of the alternatives has to be attempted.*

SECTION A

1. "Carbon prefers to share its valence electrons with other atoms of carbon or with atoms of other elements rather than gaining or losing the valence electrons in order to attain noble gas configuration." Give reasons to justify this statement. **[2]**

Solution:

Carbon does not prefer to gain or lose electrons because:

- On gaining four electrons it will form C^{4-} ion, which is highly unstable due to the large amount of energy required to overcome inter-electronic forces of repulsion. **[1]**

- On losing four electrons it will form C^{4+} ion, which is highly unstable due to the large amount of energy required to remove four electrons from the carbon atoms. **[1]**

Therefore, in order to overcome these problems, carbon prefers to share its valence electrons with other atoms of carbon or with atoms of other elements.

2. The atomic number of an element 'X' is 11.

(i) Write the electronic configurations of X and find its valency.

(ii) Write the formula and nature of its oxide. **[2]**

Solution:

                                        K L M

(i) Electronic configuration of 'X' = 2   8   1 **[½]**

Valency of 'X' = 1 **[½]**

(ii) Formula of oxide of 'X' = X_2O **[½]**

Nature of oxide of 'X' = Basic **[½]**

3. Give reasons:

(i) Placenta is extremely essential for foetal development.

(ii) Uterine lining becomes thick and spongy after fertilisation. **[2]**

Solution:

(i) Placenta is extremely essential for foetal development because of the following reasons:

    (a) The embryo gets nutrition from the mother's blood with the help of placenta. **[½]**

    (b) The developing embryo will also generate waste substances which can be removed by transferring them into the mother's blood through the placenta. **[½]**

(ii) Uterine lining becomes thick and spongy after fertilisation because it provides nurture and protection to the growing embryo. **[1]**

4. (a) Name the reproductive and non-reproductive parts of bread mould (Rhizopus).

(b) List any two advantages of vegetative propagation. **[2]**

Solution:

(a) Sporangium and spores are the reproductive parts of bread mould (*Rhizopus*) while hyphae is a non-reproductive part of bread mould. **[1]**

(b) **Advantages of vegetative propagation:**

    (i) Vegetative propagation helps in producing disease free plants.

    (ii) All plants produced by vegetative propagation are genetically similar to the parent plants.

    (iii) Vegetative propagation is usually a means of propagating plants which do not produce viable seeds.

    (iv) Plants raised by vegetative propagation can bear flowers and fruits earlier than those which are produced from seeds. **(Any two) [2×½]**

5.   Name the reproductive parts of an angiosperm. Where are these parts located? Explain the structure of its male reproductive part.   **[2]**

OR

What is puberty? Mention any two changes that are common to both boys and girls in early teenage years.

Solution:

The reproductive parts of an angiosperm are as follows:

(a)   Male reproductive part is stamen and

(b)   Female reproductive part is pistil or carpel   **[½]**

The reproductive parts of an angiosperm are located in the flower.   **[½]**

The male reproductive part or stamen produces pollens. Each stamen consists of a stalk called filament and a flattened top called anther. The anthers produce pollen grains.   **[1]**

OR

Puberty is the beginning of development for sexual maturity. It is the age at which production of sex hormones begin and boy and girl become sexually mature. It occurs at the age of 10-12 years in girls and 13-15 years in boys.   **[1]**

Changes that are common to both boys and girls in early teenage years are:

(i)   Thick hair growth in the pubic region and armpits.

(ii)   Thin hair appears on legs and arms, as well as on the face.

(iii)   The skin frequently becomes oily and there might be occurrence of acne.   **[Any two] [2×½]**

6.   (a)   Name the poles P, Q, R and S of the magnets in the following figures 'a' and 'b':   **[½+½+1 = 2]**
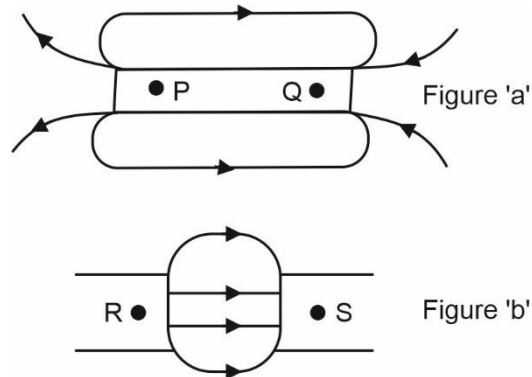
   (b)   State the inference drawn about the direction of the magnetic field lines on the basis of these diagrams.

OR

When is the force experienced by a current – carrying straight conductor placed in a uniform magnetic field.   **[1+1=2]**

(i)   Maximum ;

(ii)   Minimum ?

Solution:

In figure 'a'

(a)   P – North pole

Q – South pole   **[½]**

In figure 'b'

R – North pole

S – South pole   **[½]**

(b) On the basis of diagrams we conclude that outside the magnet, magnetic field lines emerge from north pole and merge at south pole. **[1]**

OR

(i) The force experienced by a current-carrying straight conductor is maximum when the conductor is placed perpendicular to the direction of magnetic field. **[1]**

(ii) The force experienced by a current-carrying straight conductor is minimum when the conductor is placed along the direction of magnetic field whether parallel or antiparallel. **[1]**

7. In the following food chain, only 2J of energy was available to the peacocks. How much energy would have been present in Grass? Justify your answer. **[2]**

GRASS → GRASS HOPPER → FROG → SNAKE → PEACOCK

OR

(a) What is meant by garbage? List two classes into which garbage is classified.

(b) What do we actually mean when we say that the "enzymes are specific in their action"?

Solution:

$$\text{Grass} \longrightarrow \text{Grasshopper} \longrightarrow \text{Frog} \longrightarrow \text{Snake} \longrightarrow \text{Peacock}$$
$$(20\ kJ) \qquad (2\ kJ) \qquad (200\ J) \qquad (20\ J) \qquad (2\ J)$$

According to the ten percent law of transfer of energy, if 2J of energy is available to peacock, then the amount of energy present in grass is 20 kJ. **[1]**

When green plants are eaten by herbivores, a great amount of energy is lost as heat to the environment and in various other body processes. On an average, 10% of the food (energy) is turned into the body of herbivores. Similarly, 10% of the total energy available to the herbivores is made available for the next level of consumers. **[1]**

OR

(a) Garbage is refuse of food, vegetables and fruit articles along with other domestic wastes. **[½]**

The two classes in which garbage is classified are :

(i) Biodegradable substances **[½]**

(ii) Non-biodegradable substances **[½]**

(b) Enzymes are bio-catalysts that break down complex substances into simpler ones and they are specific for the substrates on which they act. **[½]**

SECTION B

8. (a) State Newland Law of Octaves. **[1+1+½+½=3]**

(b) With an example, explain Dobereiner's Triads.

(c) List one limitation each of both the attempts mentioned in 'a' & 'b'.

Solution:

(a) Newlands' Law of Octaves states that, when elements are arranged in the order of their increasing atomic masses, the properties of every eighth element are similar to that of the first one **.** **[1]**

(b) Dobereiner classified elements in group of three and named them 'Triad' in which the middle element has the atomic mass nearly equal to the arithmetic mean of those of the other two elements, when arranged in increasing order of their atomic masses. **[½]**

e.g.: Li, Na and K form a triad.

$$\text{Atomic mass of Na} = \frac{\text{Atomic mass of Li} + \text{Atomic mass of K}}{2}$$

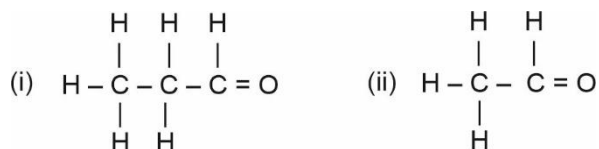$$= \frac{6.9 + 39}{2} = 22.9 \approx 23 \qquad \text{[½]}$$

(c) Limitation of Newlands' Law of Octaves:

- It is relevant only for lighter elements   (or any other limitation) **[½]**

Limitation of Dobereiner's Triads:

- The law is applicable to a limited number of elements as only 3 triads were identified at that time.   (or any other limitation) **[½]**

9. Consider the following organic compounds: **[3]**

(a) Name the functional group present in their compounds.

(b) Write the general formula for the compounds of this functional group.

(c) State the relationship between these compounds and draw the structure of any other compound having similar functional group.

OR

(a) Draw the electron dot structure for ethyne. **[1+2=3]**

(b) List two differences between the properties exhibited by covalent compounds and ionic compounds.

Solution:

(a) The functional group present in these compounds ((i) and (ii)) is aldehyde (– CHO). **[1]**

(b) The general formula for the compounds having aldehyde functional group is $C_nH_{2n}O$. **[1]**

(c) These compounds are the members of the homologous series of aldehydes. **[½]**

Structure of butanal having aldehyde functional group is-
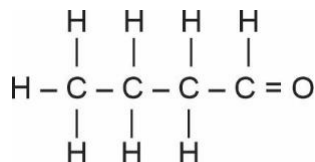
(Butanal) **[½]**

OR

(a) Electron dot structure of ethyne : **[1]**

Ethyne molecule

(b) Differences between ionic and covalent compounds :

|	Ionic compounds		Covalent compounds	
(1)	Ionic compounds are formed by complete transfer of electrons	(1)	Covalent compounds are formed by mutual sharing of electrons	**[1]**
(2)	Ionic compounds have high melting and boiling points	(2)	Covalent compounds have comparatively low melting and boiling points	**[1]**
(3)	Ionic compounds conduct electricity in aqueous solution or in molten state	(3)	Covalent compounds are generally non-conductors of electricity	

(Any two)

10. (a) Name the two types of gametes produced by men. **[½+½]**

    (b) Does a male child inherit X chromosome from his father? Justify. **[½+1]**

    (c) How many types of gametes are produced by a human female? **[½]**

Solution:

    (a) The two types of gametes produced by men are :

    22A + X and 22A + Y [A denotes autosomes] **[½+½]**

    (b) No, a male child does not inherit X chromosome from his father but from his mother. **[½]**
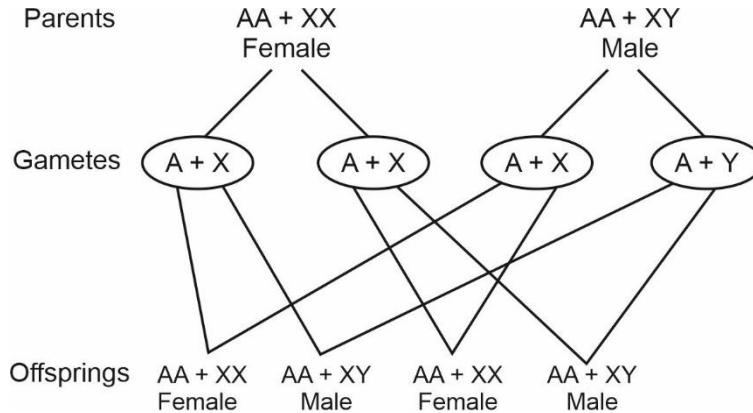
    As it is clear from the above representation, the mother passes X chromosome to male child. **[1]**

    (c) Only one type of gamete is produced by female *i.e.* 22A + X. **[½]**

11. (a) State Ohm's Law. Represent it mathematically. **[3]**

    (b) Define 1 ohm.

    (c) What is the resistance of a conductor through which a current of 0.5 A flows when a potential difference of 2 V is applied across its ends?

Solution:

    (a) Ohm's law states that "If the physical conditions remain unchanged, the potential difference across the two ends of a conductor is directly proportional to the current flowing through it".

    Mathematically, $V \propto I$

    $V = RI$ **[1]**

    where, R is the constant of proportionality and is called the resistance of the conductor.

    (b) If 1 volt of potential difference is applied across the ends of a conductor and 1 A of current flows through it, then the resistance of the conductor is said to be 1 ohm. **[1]**

    (c) $R = \dfrac{V}{I} = \dfrac{2}{0.5} = 4\ \Omega$ **[1]**

12. (a) List the factors on which the resistance of a uniform cylindrical conductor of a given material depends. **[2+1]**

    (b) The resistance of a wire of 0.01 cm radius is 10 Ω. If the resistivity of the wire is 50 × 10⁻⁸ Ω m, find the length of this wire.

OR

    (a) What is the meaning of electric power of an electrical device? Write its SI unit. **[1½]**

    (b) An electric kettle of 2 kW is used for 2h. Calculate the energy consumed in

    (i) kilowatt hour and

    (ii) joules. **[1½]**

Solution:

(a) Resistance of a uniform cylindrical conductor depends on **[4×½=2]**

   (i) Length of the conductor

   (ii) Area of cross-section of the conductor

   (iii) Nature of material of the conductor

   (iv) Temperature of the conductor

(b) r = 0.01 cm = 10^{-4} m, R = 10 Ω, ρ = 50 × 10^{-8} Ωm

$$\because \quad R = \rho \frac{l}{A} \qquad \text{[½]}$$

$$\Rightarrow \quad l = \frac{RA}{\rho} = \frac{10 \times \pi \left(10^{-4}\right)^2}{50 \times 10^{-8}}$$

$$\Rightarrow \quad l = \frac{3.14}{5} = 0.628 \text{ m}$$

$$\Rightarrow \quad l = 62.8 \text{ cm} \qquad \text{[½]}$$

OR

(a) Electric power of an electrical device is defined as its rate of consumption of electrical energy.

i.e., $P = \dfrac{E}{t}$ **[1]**

The SI unit of electrical power is watt (W). **[½]**

(b) P = 2 kW, t = 2 h

   (i) $E = P \times t = 2 \times 2 = 4$ kWh **[1]**

   (ii) E = 2000 W × 2 × 3600 s

   = 1.44 × 10^7 J **[½]**

13. (a) We do not clean ponds or lakes, but an aquarium needs to be cleaned regularly. Why? **[1+2]**

   (b) Why is ozone layer getting depleted at the higher levels of the atmosphere? Mention one harmful effect caused by its depletion.

Solution:

(a) Natural ecosystems like ponds and lakes need not to be cleaned regularly as they contain decomposers which act as cleansing agents whereas an aquarium is an artificial ecosystem and does not contain any decomposer that will cleanse it so, aquarium needs to be cleaned regularly. **[1]**

(b) The release of ozone depleting substances like chlorofluorocarbons, halogens, carbon tetrachloride in environment causes the depletion of ozone at higher levels of atmosphere. **[1]**

Depletion of ozone layer allows the UV radiation to reach the earth surface. These radiations are highly damaging to the organisms, for example, it can cause skin cancer in human beings. **[1]**

This section has 02 case based questions (14 and 15).

Each case is followed by **03** sub-questions (a, b and c).

Part (a) and (b) are compulsory. However an internal choice has been provided in Part (c).

14. Mendel blended his knowledge of Science and mathematics to keep the count of the individuals exhibiting a particular trait in each generation. He observed a number of contrasting visible characters controlled in pea plants in a field. He conducted many experiments to arrive at the laws of inheritance.

   (a) What do the F1 progeny of tall plants with round seeds and short plants with wrinkled seeds look like?

   (b) Name the recessive traits in above case.

   (c) Mention the type of the new combinations of plants obtained in F2 progeny along with their ration, if F1 progeny was allowed to self pollinate.   **[1+1+2=4]**
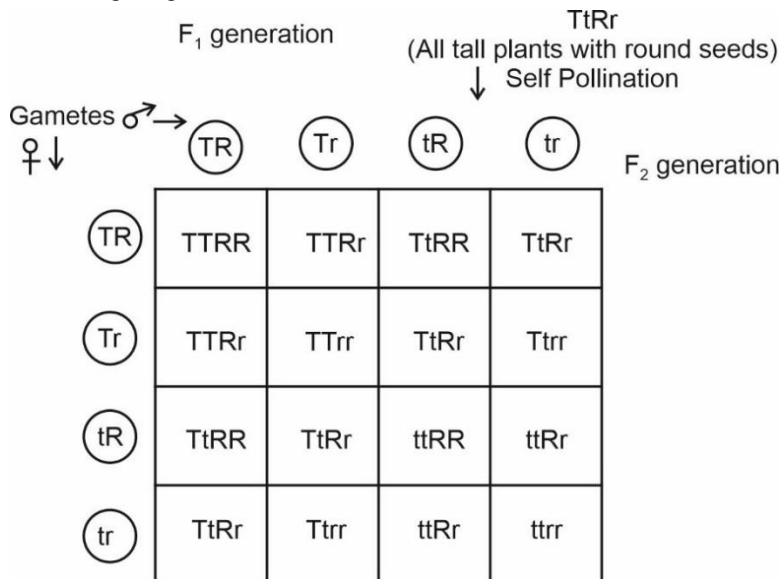
<div align="center">**OR**</div>

If 1600 plants were obtained in F2 progeny, write the number of plants having traits:

(i)   Tall with round seeds

(ii) Short with wrinkled seeds

Write the conclusion of the above experiment.

Solution:

   (a) The F_1 progeny of tall plants with round seeds (TTRR) and short plants (ttrr) with wrinkled seeds would be tall plants with round seeds (TtRr).   **[1]**

   (b) The recessive traits in the above case are short plants and wrinkled seeds.   **[1]**

   (c) On selfing F_1 generation,

[1]

- Tall and round = $\dfrac{9}{16}$

- Tall and wrinkled = $\dfrac{3}{16}$

- Short and round = $\dfrac{3}{16}$

- Short and wrinkled = $\dfrac{1}{16}$

Phenotypic ratio = 9 : 3 : 3 : 1   **[1]**

OR

If 1600 plants were obtained in F_2 progeny, then the number of

(i) Tall with round seeds $= \dfrac{9}{16} \times 1600$

$\qquad\qquad\qquad\qquad = 900$ **[1]**

$\qquad \therefore$ In F_2 progeny, 900 tall plants with round seeds are produced.

(ii) Short with wrinkled seeds $= \dfrac{1}{16} \times 1600$

$\qquad\qquad\qquad\qquad = 100$ **[1]**

$\qquad \therefore$ In F_2 progeny, 100 short plants with wrinkled seeds are produced.

Conclusion:

The above given experiment depicts the dihybrid cross that reveals Mendel's 'Law of independent assortment' which states that-

'The alleles of two different characters/traits segregate or assort independently *i.e.*, the segregation of alleles of a trait in the gametes is independent of the segregation of alleles of the other trait'. **[2]**

15. A student was asked to perform an experiment to study the force on a current carrying conductor in a magnetic field. He took a small aluminium rod *AB*, a strong horse shoe magnet, some connecting wires, a battery and a switch and connected them as shown. He observed that on passing current, the rod gets displaced. On reversing the direction of current, the direction of displacement also gets reversed. On the basis of your understanding of this phenomenon, answer the following questions: **[4]**
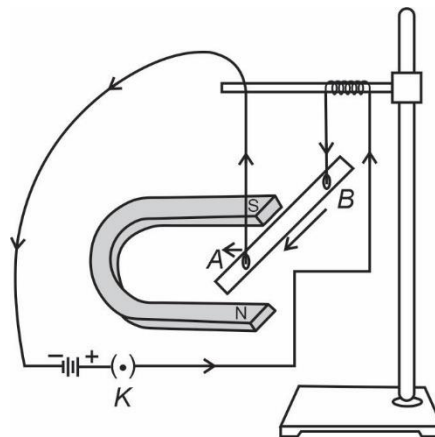
(a) Why does the rod get displaced on passing current through it?

(b) State the rule that determines the direction of the force on the conductor *AB*.

(c) (i)   If the U shaped magnet is held vertically and the aluminium rod is suspended horizontally with its end *B* towards due north, then on passing current through the rod from *B* to *A* as shown, in which direction will the rod be displaced?

(ii) Name any two devices that use current carrying conductors and magnetic field.

OR

Draw the pattern of magnetic field lines produced around a current carrying straight conductor held vertically on a horizontal cardboard. Indicate the direction of the field lines as well as the direction of current flowing through the conductor.

Solution:

(a) Because a current carrying conductor placed in a magnetic field experiences force.   **[1]**
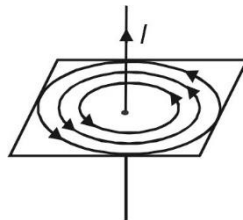
(b) **Fleming's left hand rule:**

If the forefinger, the second finger and the thumb of the left hand are stretched at right angles to each other, with the forefinger pointing in the direction of the field and the second finger in the direction of the current then the thumb indicates the direction of the force.   **[1]**

(c) (i)   Downwards   **[1]**

(ii)   Electric motor and electric generator   **[1]**

OR

The magnetic field lines around a straight current carrying conductor are concentric circles on planes perpendicular to the direction of current.   **[1]**

[1]

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