Sample Question Paper - 15
Science (086)
Class- X, Session: 2021-22
TERM II

Time Allowed: 2 hours **Maximum Marks: 40**

General Instructions:

1. All questions are compulsory.
2. The question paper has three sections and 15 questions. All questions are compulsory.
3. 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.
4. Internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

Section A

1. i. A hydrocarbon with molecular formula C_4H_{10} has how many covalent bonds? **[2]**
   ii. What is the valency of carbon in its compounds?
2. Can the following groups of elements be classified as Dobereiner's triads? **[2]**
   i. Na, Si and Cl
   ii. Be, Mg and Ca
   [Atomic mass of Be = 9, Na = 23, Mg = 24, Si = 28, Cl = 35 and Ca = 40]
   Explain by giving reason.
3. How are general growth and sexual maturation different from each other? **[2]**
4. Reproduction is essentially a phenomenon that is not for survival of an individual but for continuation of a species. Justify. **[2]**
5. A child questioned his teacher that why do organisms resemble their parents more as compared to grandparents. In which way will the teacher explain to the child? **[2]**

   OR

   What will be the blood groups of the children of following matings?
   a) $I^A I^B$ X $I^B I^B$
   b) $I^A I^O$ X $I^A I^B$
   c) $I^A I^B$ X $I^A I^B$
   d) IOIO X IA IB
6. i. What are magnetic field lines? How is the direction of a magnetic field at a point determined? Mention two important properties of magnetic field lines. **[2]**
   ii. An electric oven of 2kW power rating is operated in a domestic electric circuit (220 V) that has a current rating of 5A. What result do you expect? Explain.
7. i) What percentage of the solar energy is trapped and utilized by plants? **[2]**

ii) In an ecosystem, how the biotic and abiotic components are dependent on each other?

Section B

8. Identify, the elements with the following property and arrange them in increasing order of their reactivity. **[3]**

   i. An element which is a soft and reactive metal.

   ii. The metal which is an important constituent of limestone.

   iii. The metal which exists in liquid state at room temperature.

9. i. How many shared pairs and lone pairs are present in a molecule of H_2O? **[3]**

   ii. Write the electron dot structure of a molecule of N_2.

   OR

   i. What is octet rule?

   ii. Discuss the formation of covalent bonds in the molecules of

   a. Ammonia

   b. Ethylene

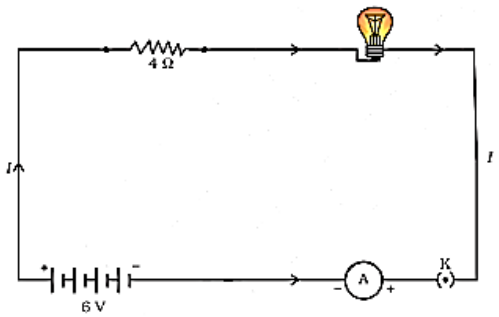
10. Explain how sexual reproduction gives rise to more viable variations than asexual reproduction. How does this affect the evolution of those organisms that reproduce sexually? **[3]**

11. i. Calculate the cost of seeing 2 movies on colour T.V. daily for the month of September. Given wattage of colour T.V. = 60 W, duration each movie is 2 hours 30 min and 1kWh costs ₹4. **[3]**

    ii. An electric kettle rated at 220 V, 2.2 kW works for 3h. Calculate the energy consumed and the current drawn.

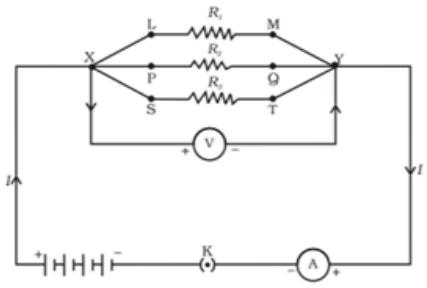
12. An electric lamp, whose resistance is 20Ω, and a conductor of 4Ω resistance are connected to a 6 V battery in figure. **[3]**

    Calculate (a) the total resistance of the circuit, (b) the current through the circuit, and (c) the potential difference across the electric lamp and conductor.



OR

In the circuit diagram given in figure, suppose the resistors R_1, R_2 and R_3 have the values 5Ω, 10Ω, 30Ω, respectively, which have been connected to a battery of 12 V. Calculate:



a. the current through each resistor,

b. the total current in the circuit, and the total circuit resistance.

13. Naman got into a quarrel with some farmers who were spraying DDT in their field. Many people gathered at the spot to see and enjoy the incident. The angry mob demanded that Naman should not interfere with the farmers' job. Naman tried to explain his point and finally succeeded. The farmers gave up spraying DDT. **[3]**

i. What did Naman explain to the farmers?

ii. What is biomagnification? Explain with an example.

iii. What values did Naman promote?

Section C

14. **Read the Case study followed by 3 questions Part (i) and (ii) are compulsory. However, an internal choice has been provided in part (iii):** **[4]**

Pea plants can have smooth seeds or wrinkled seeds. One of the phenotypes is completely dominant over the other. A farmer decides to pollinate one flower of a plant with smooth seeds using pollen from plant with wrinkled seeds. The resulting pea pod has all smooth seeds.

i. Which crosses will give smooth and wrinkled seeds in the same proportion?

ii. Which cross can be used to determine the genotype of a plant with a dominant phenotype?

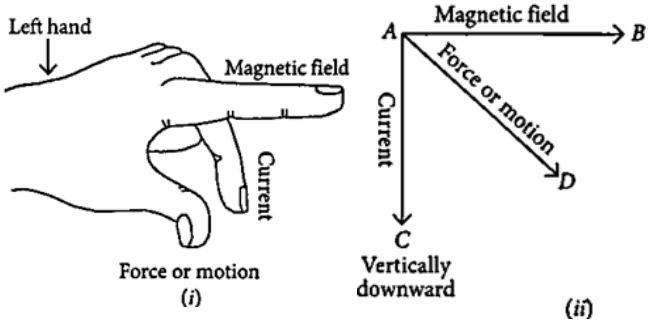
iii. On crossing of two heterozygous smooth seeded plants (Rr), a total of 1000 plants were obtained in F_1 generation. What will be the respective number of smooth and wrinkled seeds obtained in F_1 generation?

OR

The characters which appear in the first filial generation are called

15. **Read the Case study followed by 3 questions Part (i) and (ii) are compulsory. However, an internal choice has been provided in part (iii):** **[4]**

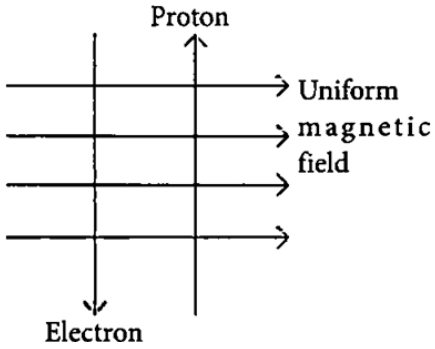
Andre Marie Ampere suggested that a magnet must exert an equal and opposite force on a current carrying conductor, which was experimentally found to be true. But we know that current is due to charges in motion. Thus, it is clear that a charge moving in a magnetic field experience a force, except when it is moving in a direction parallel to it. If the direction of motion is perpendicular to the direction of magnetic field, the magnitude of force experienced depends on the charge, velocity (v), strength of magnetic field (B), and sine of the angle between v and B. Direction of magnetic force is given by Fleming's left hand rule.



i. If an electron is travelling horizontally towards east. A magnetic field in vertically downward direction exerts a force on the electron along which direction?

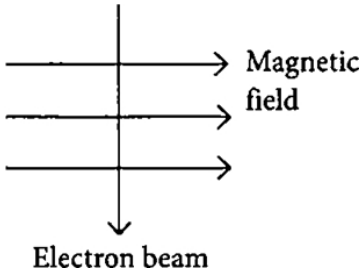
ii. If a charged particle is moving along a magnetic field line. Then What would be the magnetic force on the particle?

iii. A uniform magnetic field exists in the plane of paper pointing from left to right as shown in figure. In the field, an electron and a proton move as shown. Where do the electron and the proton experience the force?



OR

An electron beam enters a magnetic field at right angles to it as shown in the figure. What would be the direction of force acting on the electron beam?



Solution

SCIENCE - 086

Class 10 - Science

Section A

1. i. Butane C_4H_{10} has 3 C-C covalent bonds and 10 C-H covalent bonds. Thus, it has 13 covalent bonds.

   ii. The valency of carbon is four.

2. i. Given, Atomic mass of Na = 23, Atomic Mass of Si=28 and Atomic Mass of Cl =35.

   Average atomic mass of Na and Cl = $\frac{23+35}{2} = \frac{58}{2}$ = 29.

   Since, the arithmetic mean of atomic masses of Na and Cl is not equal to the atomic mass of Si. Also, the properties of Na, Si and Cl are different. Therefore, it does not form Dobereiner's triads.

   ii. Given, Atomic mass of Be = 9, Atomic Mass of Mg=24 and Atomic Mass of Ca =40.

   Average atomic mass of Be and Ca = $\frac{9+40}{2} = \frac{49}{2}$ = 24.5

   Since, the arithmetic mean of atomic masses of Be and Ca is nearly equal to the atomic mass of Mg. Also, Be, Mg and Ca have many similar properties. Therefore, it forms Dobereiner's triads.

3. General growth refers to different types of developmental process in the body like increase in height, weight gain, changes in shape and size of the body but sexual maturation is specific to changes reflected at puberty like cracking of voice, new hair patterns, development of breast in female, etc.

4. For survival, an individual needs energy which it obtains from life processes such as nutrition and respiration. Reproduction does not provide energy for survival. Instead, reproduction ensures transfer of genetic material from one generation to the next which helps in continuation of species. Hence, it is an important phenomenon for maintaining continuity of species.

5. The two parents involved in sexual reproduction produce gametes which fuse together forming a zygote. It gradually develops into a young child showing certain similarities with the parents.
   Since, a child inherits its characters from both the parents the resemblance with them is very close. The grandparents and the child resemble less closely because a gap of gene pool is created by the parents of the child. Since the child is immediate generation next to his parent thus to carry more similar genes as that of parents. Variations are more with grandparents.

   OR

   a) When a cross is made between I^AI^B x I^BI^B, then the two individuals will belong to blood group AB and two to blood group B.

   b) Similarly when a cross is made between I^AI^O x I^AI^B, then the two individuals will belong to blood group A one to AB and one to blood group B.

   c) When a cross is made between I^AI^B x I^AI^B, then the two individuals will belong to blood group AB, one to A and one to blood group B.

   d) When a cross is made between I^OI^Ox I^AI^B, then the two individuals will belong to blood group A and two to blood group B.

6. i. The magnetic field lines of force are the lines drawn in a magnetic field along which a hypothetical north magnetic pole would move if it is free to do so.
   The direction of a magnetic field at a point is the direction of the resultant force acting on a hypothetical north pole placed at that point.The tangent at any point on the magnetic field line gives the direction of magnetic field at that point. The direction of the magnetic field at a point can be found by placing a small magnetic compass at that point. The north end of the needle indicates the direction of the field.
   Two important properties of the magnetic lines of force are:>
   a. The magnetic lines of force start from north pole and terminate at south pole. Inside the magnet they travel from south pole to north pole. Thus, they are closed curves.
   b. They do not intersect each other because at the point of intersection there will be two directions of same magnetic field which is impossible.

   ii. Power P = 2kW = 2,000 W, V = 220 volts, I = ?

   P = VI or $I = \frac{P}{V}$

$I = \frac{2000}{220} = \frac{100}{11} = 9.09\ A$

A current of 9.09 A will flow in the circuit. Since the current rating of circuit is 5A, the fuse (of 5A) rating if inserted in circuit will burn up. If no fuse has been put in the circuit, there may be a fire.

7. 1) The plants utilize only 1% of the solar energy.
   2) (a) Forests (b) Sea.

Section B

8. i. The elements which are soft and reactive metal are sodium (Na) and potassium(K) both of which are alkali metals and are very reactive, they can be cut easily with knife, thus they are very soft.
   ii. Limestone is calcium carbonate $CaCO_3$. The important constituent of limestone is calcium (Ca), which is an alkaline earth metal.
   iii. Metal which exists in liquid state at room temperature is mercury (Hg).
   So, the increasing order of their reactivity is:
   mercury < calcium < sodium
   or, Hg < Ca < Na
9. i. Since water is basically H-OH and Hydrogen doesnt have any lone pairs, only Oxygen needs to be considered. Since it is a single sigma bond between each two hydrogens, remaining 4 electrons will stay as 2 lone pairs on Oxygen.
   Shared pairs = 2 ; lone pairs = 2.

   $\left[H : \ddot{\underset{\cdot\cdot}{O}} : H\right]$

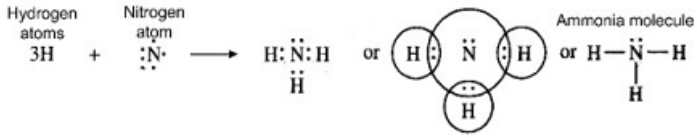
   ii. A nitrogen atom has 5 electrons in its outer shell. Nitrogen is in group 5 of the periodic table. Two nitrogen atoms will each share three electrons to form three covalent bonds and make a nitrogen molecule (N_2).

   $\dddot{N}\vdots\dddot{N}$

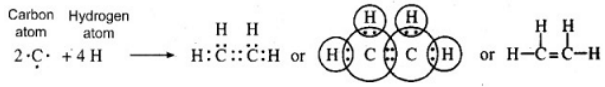
   OR

   i. According to octet rule, an atom always tends to have eight electrons in its outermost shell or Valence shell. This may be done either by the transfer of electrons from one atom to the other or by the sharing of electrons in the atoms.

   ii. a. Covalent bonds in ammonia (NH_3) molecule: The atomic number of nitrogen is 7. Its electronic configuration is 2, 5. This means that nitrogen atom has five valence electrons. In order to have eight electrons in the valence shell, the nitrogen atom shares three electrons with the electrons of three hydrogen atoms. Thus, nitrogen atom gets linked to three hydrogen atoms by three covalent bonds. The formation of ammonia molecule may be shown as follows:



   b. Covalent bonds in ethylene (C_2H_4) molecule: Ethylene molecule has two carbon atoms. Each carbon atom shares two electrons with the two hydrogen atoms. At the same time, both the carbon atoms mutually share two electrons each. Thus both the carbon atoms get linked by double bond. Each carbon atom also gets linked to two hydrogen atoms by single bonds. The formation of ethylene molecule may be shown as follows:



10. In sexual reproduction, two individuals having different variations combine their DNA to give rise to a new individual. Therefore, sexual reproduction allows more variations, whereas, in asexual reproduction, chance variations can only occur when the copying of DNA is not accurate. Additionally, asexual reproduction allows very less variations because if there are more variations, then the resultant DNA will not be able to survive inside the inherited cellular apparatus. However, in sexual reproduction, more variations are allowed and the resultant DNA is also able to survive, thus making the variations viable.
    Variation and Evolution: Variants help the species to survive in all the conditions. Environmental conditions such as heat, light, pests, and food availability can change suddenly at only one place. At that time, only those

variants resistant to these conditions would be able to survive. This will slowly lead to the evolution of a better-adapted species.Thus, variation helps in the evolution of sexually reproducing organisms.

11. i. Wattage of colour T.V. = 60 W
    Number of hours for which colour T.V. is on during September = $2 \times 2\frac{1}{2} \times 30 = 150h$
    Energy consumed = $\frac{watt \times hour}{1000} = \frac{60 \times 150}{1000} = 9\ kWh$
    Cost of seeing 2 movies per day for 30 days = 9 × 4 = ₹36 only
    ii. Energy consumed (in kWh) = power (in kW) × time (h) = 2.2 kW × 3h = 6.6 kWh
    Power = 2.2 kW = 2.2 × 1,000 W = 2,200 W
    But Power = Voltage × Current
    2,200 = 220 × I
    $I = \frac{2200}{220} = 10\ A$
12. The resistance of electric lamp, $R_1 = 20\Omega$,
    The resistance of the conductor connected in series, $R_2 = 4\Omega$
    Then the total resistance in the circuit
    R = R
    1 + R_2
    $R_s = 20\Omega + 4\Omega = 24\Omega$
    The total potential difference across the two terminals of the battery
    V = 6 V.
    Now by Ohm's law, the current through the circuit is given by
    $I = \frac{V}{R}$
    $\frac{6V}{24\Omega}$
    = 0.25A
    Applying Ohm's law to the electric lamp and conductor separately,
    We get potential difference across the electric lamp,
    $V_1 = 20\Omega \times 0.25\text{A}$V
    = 5V
    and,
    that across the conductor, $V_2 = 4\Omega \times 0.25\text{A}$
    = 5V
    and,
    that across the conductor, $V_2 = 4\Omega \times 0.25\text{A}$
    = 1V
    Suppose that we like to replace the series combination of electric lamp and conductor by a single and equivalent resistor. Its resistance must be such that a potential difference of 6 V across the battery terminals will cause a current of 0.25 A in the circuit. The resistance R of this equivalent resistor would be
    $R = \frac{V}{I}$
    $= \frac{6V}{0.25A}$
    $= 24\Omega$
    This is the total resistance of the series circuit; it is equal to the sum of the two resistances.

    OR

    $R_1 = 5\Omega$, $R_2 = 10\Omega$, and $R_3 = 30\Omega$
    Potential difference across the battery, V = 12 V.
    This is also the potential difference across each of the individual resistor; therefore, to calculate the current in the resistors, we use
    Ohm's law.
    The current I1, through R1 $= \frac{V}{R_1}$
    $I_1 = \frac{12V}{5\Omega}$ = 2.4 A
    The Current I_2, through R_2 = $= \frac{V}{R_2}$
    $I_2 = \frac{12V}{10\Omega} = 1.2A$

The current I_3, through $R_3 = \frac{V}{R_3}$

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

The total current in the circuit,

I = I1 + I2 + I3

= (2.4 + 1.2 + 0.4)A

= 4A

The total resistance Rp, is given by $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$\frac{1}{R_p} = \frac{1}{5} + \frac{1}{10} + \frac{1}{30} = \frac{1}{3}$

Thus, $R_p = 3\Omega$

13. i. Naman explained the health hazards of using DDT on our environment and other animals to farmers, i.e.
    a. DDT is a non-biodegradable substance and it persists in environment for long time and cause environmental pollution.
    b. DDT could enter into a food chain and everyone associated would be affected due to its accumulation in their body.

    ii. Biomagnification refers to increase in concentration of the toxicant at successive trophic levels. This happens because this toxic substance gets accumulated in the organism which cannot be metabolised or excreted and is thus, passed onto the next higher trophic level.

    iii. Naman promotes health awareness, eco-friendly nature, sympathy and determination to support the right cause.

Section C

14. i. Rr $\times$ rr

    ii. Rr $\times$ rr

    iii. The crossing between two heterozygous smooth seeded (Rr) plants would give phenotypic ratio of 3 smooth seeded plant: 1 wrinkled seeded plant. If plants obtained were 1000, then the number of smooth and wrinkled plants will be closed to 750 and 250 respectively.

    OR

    dominant characters

15. i. Fleming's left hand rule is used to determine the direction of force on electron i.e., in south direction.

    ii. The angle between velocity and magnetic field is zero. Therefore, magnetic force on the particle is zero.

    iii. As the direction of current is taken opposite to the direction of motion of electrons, therefore, current from the motion of electron and proton is in the same direction, i.e., from bottom to top. Now, according to Fleming's left hand rule, the electron and the proton experience forces both pointing into the plane of paper.

    OR

    into the page