Sample Question Paper - 14
Science (086)
Class- X, Session: 2021-22
TERM II

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

General Instructions:

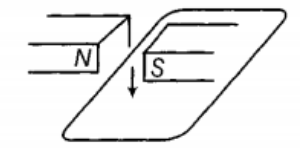
1. All questions are compulsory.
2. The question paper has three sections and 15 questions. All questions are compulsory.
3. Section–A has 7 questions of 2 marks each; Section–B has 6 questions of 3 marks each; and Section–C has 2 case-based questions of 4 marks each.
4. Internal choices have been provided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

Section A

1. i. What is a homologous series? State any two characteristics of homologous series? **[2]**
   ii. Why carbon and its compounds are used as fuels in most cases?
2. The electrons in the atoms of four elements A, B, C and D are distributed in three shells having 1, 3, 5 and 7 electrons respectively in their outermost shells. **[2]**
   i. Write the group numbers in which these elements are placed in the Modern Periodic Table.
   ii. Write the electronic configuration of the atoms of B and D and the molecular formula of the compound formed when B and D combine.
3. How does fertilisation take place? Fertilisation occurs once in a month. Comment. **[2]**
4. i. Name the site of implantation and development of baby in human female. **[2]**
   ii. Mention any two benefits of using barrier method during sexual act.
5. Mendel took tall pea plants and short pea plants and produced F_1 progeny through cross-fertilisation. What did Mendel observe in the F_1 progeny? **[2]**

   OR

   Mendel observed two kinds of ratios 3 : 1 and 1 : 2 : 1 in F2 generation in his experiments on garden pea. Name these two kinds of ratios respectively.
6. The wire in the figure below is being moved downwards through the magnetic field, so as to produce induced current. **[2]**



   i. What would be the effect of using a stronger magnet?
   ii. What would be the effect of holding the wire still in the magnetic field?
7. How much energy will be available to hawk in the food chain comprising hawk, snakes, paddy **[2]**

and mice if 10000 J of energy are available to paddy from the sun?

Section B

8. Ria and Rama are students of Class X. Ria is very much organised and maintained. The teachers love her. She earns a great respect in the class whereas Rama is unorganised and always faces a lot of problems in handling the situations. Read the given passage and answer the following questions. **[3]**

   i. In your opinion how does organisation help in daily life?

   ii. How can you relate the above fact with the chapter classification of elements?

   iii. What is the associated value the learner acquires from the given passage?

9. i. Define covalent bond. Explain with the help of examples. **[3]**

   ii. Discuss the important characteristics of covalent compounds.

   OR

   Give reasons for the following observations:

   a. The element carbon forms a very large number of compounds.

   b. Air holes of a gas burner have to be adjusted when the heated vessels get blackened by the flame.

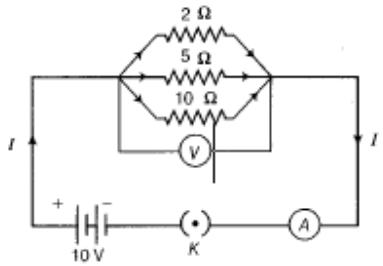
   c. Use of synthetic detergents causes pollution of water.

10. Explain Mendel's observation when he crossed a homozygous tall (TT) plant with homozygous dwarf (tt) plant followed by self-cross. **[3]**

11. i. An electric iron consumes energy at a rate of 840 W when heating is at the maximum rate and 360 W when the heating is at the minimum rate. The applied voltage is 220 V. What is the value of current and the resistance in each case? **[3]**

    ii. Which uses more energy, a 250 W TV set for 1 hour or a 1,200 W toaster for 10 minutes?

12. A circuit diagram is given as shown below: **[3]**



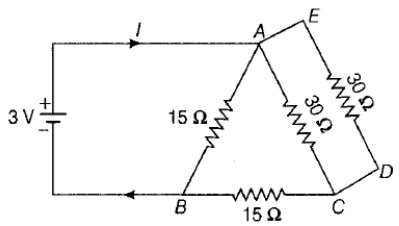
Calculate

i. the total effective resistance of the circuit.

ii. the total current in the circuit and the current through each resistor.

OR

i. Find the value of current in the circuit given as below:



ii. You have four resistors of 8Ω each. Show how would you connect these resistors to have effective resistance of 8Ω?

13. One day Mohan found his neighbours burning plastic wastes in an open space near to his house. He explained three methods to save the environment from plastic wastes to them. Imagine yourself in methods that Mohan might have told to his neighbours. What value was exhibited by Mohan in this situation? **[3]**

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]**

Gregor Mendel conducted hybridization experiments on garden peas for seven years and proposed the laws of inheritance in living organisms. He investigated characters in the garden pea plant that were manifested as two opposing traits, e.g., tall or dwarf plants, yellow and green seeds, etc.

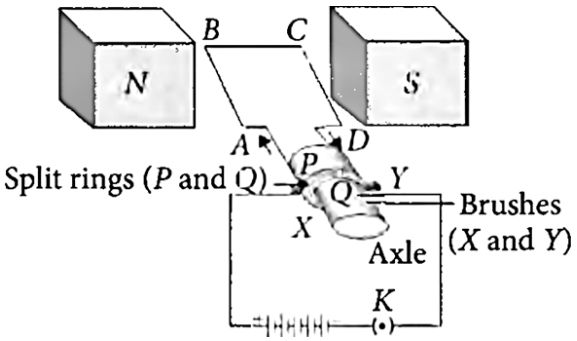
i. Among the seven pairs of contrasting traits in pea plants as studied by Mendel, What are the number of traits related to flower, pod, and seed respectively?
ii. What are the color-based contrasting traits in seven contrasting pairs, studied by Mendel in pea plants?
iii. What are some of the dominant traits studied by Mendel in pea plants?

OR

Write the scientific name of the plant on which Mendel carried out his experiments.

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]**

An electric motor is a rotating device that converts electrical energy into mechanical energy. The electric motor is used as an important component in electric fans, refrigerators, mixers, washing machines, computers, MP3 players, etc.



An electric motor consists of a rectangular coil ABCD of insulated copper wire. The coil is placed between the two poles of a magnetic field such that the arm AB and CD are perpendicular to the direction of the magnetic field. The ends of the coil are connected to the two halves P and Q of a split ring. The inner sides of these halves are insulated and attached to an axle. The external conducting edges of P and Q touch two conducting stationary brushes X and Y, respectively, as shown in the figure.

Commercial motors use an electromagnet in place of a permanent magnet, a large number of turns of conducting wire in the current carrying coil and a soft iron core on which the coil is wound.

i. Which factor has no effect on the size of the turning effect on the coil of an electric motor?
ii. When current is switched ON, an electric fan converts which energy?

iii. In an electric motor, what is the name of the device that makes contact with the rotating rings and through them to supply current to the coil?

OR

In an electric motor, the direction of current in the coil changes once in how many rotation/rotations?

Solution

SCIENCE - 086

Class 10 - Science

Section A

1. i. A **homologous series** is a series of similarly constituted compounds in which the different members have the same functional group and same chemical properties and in which any two successive members differ in their molecular formula by -CH_2 group. The various organic compounds that form part of the **homologous series** are called **homologues.**

   E.g. All **alkanes** have similar structures with single covalent bonds and show similar chemical properties. Thus, all alkanes form a homologous series. The successive members CH_4 (methane), C_2H_6 (ethane), C_3H_8 (propane), etc of alkanes differ from each other by -CH_2 group.

   Two characteristics of homologous series are as follows**:**

   a. All the compounds of a homologous series have the same functional group. E.g. All alkanes have single covalent bonds between carbon atoms in their structure.

   b. All the compounds of a homologous series have the same chemical properties. E.g. All alkanes undergo substitution reactions with halogen vapours in the presence of light.

   $$CH_3 - CH_3 + Cl_2 \xrightarrow{sunlight} CH_3 - CH_2Cl + HCl$$

   ii. Carbon present in carbon coumpounds burns in oxygen or air to form carbon dioxide (CO_2) gas. This reaction is highly exothermic, that is why different forms of coal are used as fuels.

   E.g. When propane (C_3H_8) is burnt in air, a large quantity of heat is produced.

   $$C_3H_8 + 5O_2 \rightarrow 3CO_2 \uparrow + 4H_2O + Heat$$

2.

Elements	Outermost electrons	Group No.
A	1	1^{st}
B	3	13^{th}
C	5	15^{th}
D	7	17^{th}

   The electronic configuration of B = 2, 8, 3 and D = 2, 8, 7

   The valency of B is 3 and valency of D is 1. Therefore when B and D combine, the molecular formula is BD_3.

3. Fusion of male gamete sperm and female gamete egg in fallopian tube (oviduct) is called as fertilization. The process starts with introduction of sperms, produced in testes of male, into the vagina of the woman through penis during copulation or mating. Highly active and mobile sperms pass from cervix through the uterus into the oviducts. Ovulation, in female, releases ovum in oviduct. Irrespective of release of millions of sperms into the vagina at one time, only one sperm fuses with the ovum in the oviduct to form a zygote i.e. fertilization.

   Ovulation is release of ovum from ovary into oviduct and takes place only once in a month i.e. 14^{th} day of menstrual cycle. Hence, fertilization can occur only once in a month.

4. i. The site of implantation and development of baby in human female is Uterus.

   ii. Two benefits of using barrier method during sexual act are:

   a. Protection from sexually transmitted diseases.

   b. Prevention of pregnancy.

5. He obseved that all the pea plants produced in F_1 progeny were tall due to the dominant characterstics of tall gene.

   OR

   i) Phenotypic ratio

   ii) Genotypic ratio

6. i. The magnitude of induced current increases.

   ii. The induced current is zero.

7. → The food chain may be written as
Paddy → Mice → Snake → Hawk
(10,000 J of energy from sun)
According to ten per cent law, energy available to next level is 10% of the energy transferred from the previous level.
Energy transferred to mice from paddy = 10% of 10,000 J = $\frac{10 \times 10000}{100} = 1000J$
Energy transferred to snake from mice = 10% of 1000 J = $\frac{10 \times 1000}{100} = 100J$
Energy transferred to hawk from snake = 10% of 100 J = $\frac{10 \times 100}{100} = 10J$
Energy available to Hawk = 10 J

Section B

8. i. Organisation makes our life simple, easy and systematic. On the other hand, unorganization faces a lot of problems in handling the situations.
ii. As an organisation helps us in our daily life in the same way classification of elements makes the study of elements easier and simple. It becomes easy to reproduce. Otherwise, it becomes difficult to remember all the elements and their properties.
iii. The learner will be motivated to adopt a well-disciplined and organized life.

9. i. Covalent bond: The bond formed by equal contribution and mutual sharing of electrons between two atoms so that both the atoms acquire the stable nearest noble gas configuration i.e. get their octet complete is called covalent bond.
The mutually shared electrons become the common property of both the bonded atoms.
The number of electrons contributed by an atom of the element for mutual sharing during the formation of a covalent bond is called its covalency.
Each pair of shared electrons is represented by putting a single line (—) between two atoms.
In the example given below :

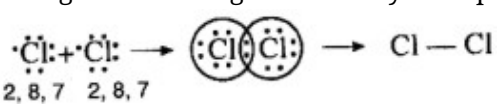
Element	At no.	Electronic configuration
H	1	1
C	6	2,4
O	8	2, 6
N	7	2, 5

Examples,

a. Formation of a hydrogen molecule(H_2): At no. of hydrogen = 1. It has one electron is the first orbit.
When two hydrogen atoms approach each other they share their single electron present in their first orbits. Each hydrogen atom can now be thought of as having noble gas configuration of helium. It may represented as:

Formation of H_2 molecule

b. Formation of chlorine molecule. Two chlorine atoms combine with each other to form a molecule of chlorine. In this case, both the atoms have seven electrons in their outermost shell and they contribute one electron each to form a covalent bond. Thus, both the chlorine atoms acquire noble gas configuration of argon. This may be depicted as:



Formation of Cl_2 molecule

c. Formation of HCl molecule. A covalent bond is formed not only between similar atoms but it may be formed between dissimilar atoms also. For example, hydrogen and chlorine form a covalent bond between their atoms. Hydrogen atom has only one electron and chlorine atom has seven electrons in its valence shell. Therefore, by mutual sharing of electron pair between a hydrogen and a chlorine

atom both the atoms acquire nearest noble gas configuration. Hydrogen atom acquires electronic configuration of helium whereas chlorine atom gets electronic configuration of argon.

ii. **The important characteristics of covalent compounds are as follows :**

a. Covalent compounds consist of molecules. Covalent compounds do not have any ions. Therefore, they consist of molecules. For example, H_2,Cl_2, H_2O, NH_3 etc.

b. Covalent compounds are liquids or gases in nature. We have studied that the ionic compounds are crystalline solids. But only a few covalent compounds are solids (e.g. sugar, glucose, iodine). These are mostly liquids (water, ethyl alcohol) or gases (oxygen, hydrogen, ammonia) at room temperature. Actually, the attractive forces in covalent molecules are weak and these molecules are not as close lo one another as the ionic solids.

c. Covalent compounds have low melting and boiling points. As covalent molecules do not have ions, the attractive forces among them are weak. Therefore, the covalent molecules can be easily separated from each other. In other words, they have low melting and boiling points.

d. Covalent compounds do not conduct electricity. Covalent compounds normally do not conduct electricity. Some of them are poor conductors of electricity. The current is carried by the ions. As covalent compounds do not have ions, these are poor conductors of electricity.

e. Covalent compounds are insoluble in water. Covalent compounds generally do not dissolve in water. They are soluble in alcohol, ether, benzene etc. which are called organic solvents. However some of them such as ammonia and ethyl alcohol are water soluble.

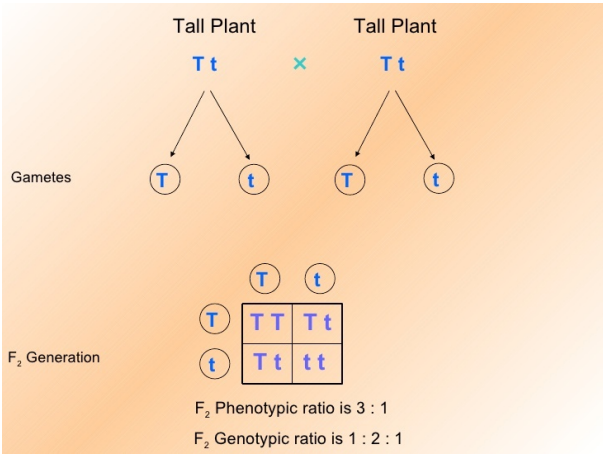
OR

a. Carbon forms large number of compounds since carbon is small in size and can form stable covalent bonds (catenation) and it shows tetravalency.

b. Air holes of gas burner are made open (adjusted) so that air can pass through, which is needed for complete combustion, so that heated vessels do not blackened.

c. Some synthetic detergents are non-biodegradable, therefore, cause pollution of water.

10. When Mendel crossed a homozygous tall (TT) plant with homozygous dwarf (tt) plant, all plants in F_1 generation were tall (Tt).
Self crossing of F_1 gives F_2. F_2 generation had 3 tall : 1 recessive plants.
Since presence of dwarf allele was masked by tall allele in F_1, tall allele (T) was dominant over dwarf allele (t).



11. i. P = VI
Then, $I = \frac{P}{V}$
When heating is at the maximum rate,
I = $\frac{840\ W}{220\ V}$ = 3.82 A
and the resistance the electric iron is
$R = \frac{V}{I} = \frac{220\ \text{V}}{3.82\ \text{A}} = 57.59\,\Omega$
when heating is at the minimum rate,
$I = \frac{360\ \text{W}}{220\ \text{V}} = 1.64\,\text{A}$

and the resistance of the electric iron is

$R = \frac{V}{I} = \frac{220\ V}{1.64\ A} = 134.15\ \Omega$

ii. Energy consumed $E_1 = P_1t_1$ = 250 W $\times$ 1h = 250 $\frac{J}{S} \times$ 3600s

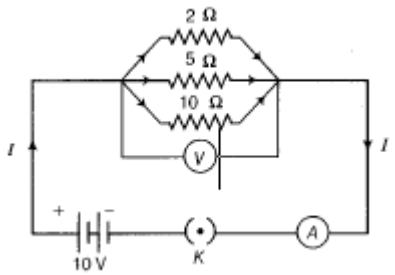
E1 = 900000J

$E_2 = P_2t_2$ = 12000W $\times$ 10 min

E_2 = 1200 $\frac{J}{S} \times$ 600s

E_2 = 720000J

$\therefore$ 250 Ω TV set consumes more energy.

12. 

i. Effective resistance is,

$\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

$= \frac{1}{2} + \frac{1}{5} + \frac{1}{10} = \frac{5+2+1}{10} = \frac{8}{10}$

$\Rightarrow R_{eff} = \frac{10}{8} = 1.25\Omega$

ii. Total current,

$I = \frac{V}{R_{eff}}$

$= \frac{10}{1.25}$

$= 8A$

iii. Current through each resistor,

$I_1 = \frac{V}{R_1} = \frac{10}{2} = 5A,$

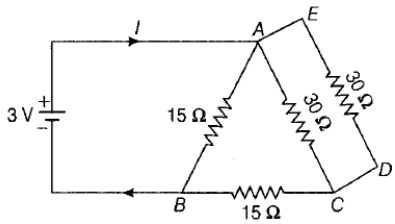
$I_2 = \frac{V}{R_2} = \frac{10}{5} = 2A$

and

$I_3 = \frac{V}{R_3} = \frac{10}{10} = 1A.$

OR

According to the question,



i. R_{AC} and R_{ED} are in parallel,

$\frac{1}{R'_P} = \frac{1}{R_{AC}} + \frac{1}{R_{ED}} = \frac{1}{30} + \frac{1}{30} = \frac{1}{15}$

$\Rightarrow \quad R'_P = 15\Omega$

Now, R'_p and R_{BC} are in series,

$R'_S = R'_P + R_{BC} = 15 + 15 = 30\Omega$

Again, R_{AB} and R'_S are in parallel,

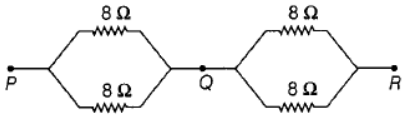
$\frac{1}{R''_P} = \frac{1}{R_{AB}} + \frac{1}{R'_S} = \frac{1}{15} + \frac{1}{30} = \frac{1}{10}$

$\therefore \quad R''_P = 10\Omega$

So, current is

$I = \frac{V}{R''_P} = \frac{3}{10} = 0.3\text{A}$

ii. Two 8Ω resistors are connected in parallel. Two such parallel combination must be connected in series to get effective resistance of 8Ω.



13. Methods to save the environment from effects of plastic wastes are:
    i. Use paper or cloth bags to carry things instead of plastic bags as paper bags are biodegradable causing less pollution in environment.
    ii. Recycle the plastic waste by sending it to factories for processing as plastics are non biodegradable.
    iii. Dispose off the plastic wastes in separate boxes that are placed for non-biodegradable wastes.
    Mohan exhibited values of a responsible, concerned citizen, who is talking efforts to conserve environment.

Section C

14. i. 2, 2, 2
    Characters studied by Mendel are as follows:

	Trait studied	Dominant	Recessive
1.	Plant height	Tall (T)	Dwarf (t)
2.	Flower position	Axial (A)	Terminal (a)
3.	Flower colour	Violet (V) or (W)	White (v) or (w
4.	Pod shape	Full or Inflated (I) or (C)	Constricted (i) or (c)
5.	Pod colour	Green (G) or (Y)	Yellow (g) or (y)
6.	Seed shape	Round (R) or (W)	Wrinkled (r) or (w)
7.	Seed colour	Yellow (Y) or (G)	Green (y) or (g)

    ii. 3
    iii. violet flower colour, green pod colour and round seed shape

    OR

    He took: Pea (Pisum sativum) plant.

15. i. The direction of the current has no effect on the size of the turning effect on the coil.
    ii. Electric fan works on the principle of electric motor. It converts electrical energy to mechanical energy.
    iii. brushes

    OR

    half rotation