

Sample Question Paper - 41
Science (086)
Class- X, Session: 2021-22
TERM II

Time allowed : 2 hours

Maximum 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. What are hydrocarbons? Explain with examples.
2. The table shows the formulae of three organic compounds that belong to the same homologous series.

| | |
|---|--|
| First member of the homologous series | $\begin{array}{c} \text{H}-\text{C}-\text{H} \\ \\ \text{O} \end{array}$ |
| Second member of the homologous series | $\begin{array}{c} \text{CH}_3-\text{C}-\text{H} \\ \\ \text{O} \end{array}$ |
| Third member of the homologous series | $\begin{array}{c} \text{CH}_3-\text{CH}_2-\text{C}-\text{H} \\ \\ \text{O} \end{array}$ |

What is the general formula of this series? Why are they considered as member of same homologous series?

OR

Give the molecular formula of :

- (i) Fourth member of alkane series.
 - (ii) Sixth member of alkene series.
3. What are the benefits of using mechanical barriers during sexual act?
 4. "An individual cannot pass on to its progeny the experiences of its lifetime". Justify the statement with the help of an example and also give reason for the same.
 5. Industrialisation is one main cause of deterioration of environment. Discuss.

OR

In a village in Karnataka, people started cultivating crops all around a lake which was always filled with water. They added fertilisers to their field in order to enhance the yield. Soon they discovered that the waterbody was completely covered with green floating plants and fish started dying in large numbers.

Analyse the situation and give reasons for excessive growth of plants and death of fish in the lake.

6. (a) N, O, F cannot be classified as Döbereiner's triad. Why?
(b) Name three elements for which Mendeleev left gaps in the periodic table?

OR

- (a) From the list of the elements given below, select three elements which form a Döbereiner's triad. F, Mg, Ca, Br, Li, Rb, Cl, Sr, I.
- (b) In Mendeleev's Periodic Table, the elements were arranged in the increasing order of their atomic masses. However, cobalt with atomic mass of 58.93 amu was placed before nickel having an atomic mass of 58.71 amu. Give reason for the same.
7. (a) Write the relation between resistance (R) of filament of a bulb, its power (P) and a constant voltage (V) applied across it.
- (b) Power of a lamp is 60 W. Find the energy in joules consumed by it in 1 s.

SECTION - B

8. Fusion of male gamete and female gamete cannot take place in flowers if pollination does not occur. Explain.

OR

- (i) Give the most important characteristic feature of the organisms which reproduce by fragmentation. Can the multicellular organisms having complex organisation of body reproduce by this method? Give reasons.
- (ii) What will happen if the cells/tissues are removed from the growing tip of a plant and placed in artificial media? Can this method be used in propagation of plants? Give any three advantages of such propagation.
9. How will you justify selection of pea plant by Mendel for heredity experiments?
10. State the rule to determine the direction of
- (a) magnetic field produced around a straight conductor carrying current,
- (b) force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it, and
- (c) current induced in a coil due to its rotation in a magnetic field.
11. (a) Describe an activity to show how can you make an electromagnet in your school laboratory.
- (b) Core of an electromagnet must be of soft iron but not steel. Justify it.

OR

Draw a labelled diagram of an electric motor. Explain its principle. What is the function of a split-ring in an electric motor?

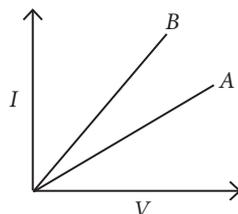
12. With the help of a flow chart explain in brief how the sex of a newborn is genetically determined in human beings. Which of the two parents, the mother or the father, is responsible for determination of sex of a child?
13. How can we help in reducing the problems of waste disposal? Suggest any three ways.

SECTION - C

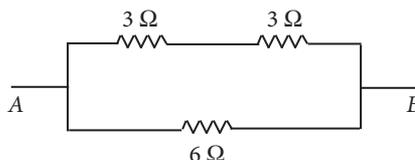
This section has 02 case-based questions (14 and 15). Each case is followed by 03 sub-questions (a, b and c). Parts a and b are compulsory. However, an internal choice has been provided in part c.

14. Several resistors may be combined to form a network. The combination should have two end points to connect it with a battery or other circuit elements. When the resistances are connected in series, the current in each resistance is same but the potential difference is different in each resistor. When the resistances are connected in parallel, the voltage drop across each resistance is same but the current is different in each resistor.

- (a) In which combination series or parallel the household circuits are connected.
- (b) The two wires A and B , each of resistance R , initially connected in series and then in parallel. In the graph it shows the resistance in series and in parallel. In the given graph which combination is denoted by wires A and B ?

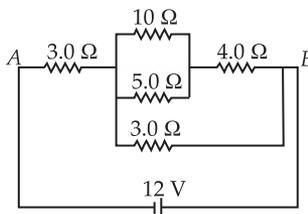


- (c) Find the equivalent resistance between A and B .



OR

In the circuit shown, find the equivalent resistance between A and B .



15. The recurrence of properties of the elements after a certain regular intervals, when they are arranged in the increasing order of their atomic numbers, is called periodicity. There are a number of physical properties such as atomic size, metallic and non-metallic character, etc. which show periodic variation. In periodic table, various properties vary differently from moving left to right in a period and going down in a group. In a period, properties vary because from moving left to right in a period, number of shells remain same but valence electron increases by one number hence nuclear charge increases. In a group, on going down, number of valence shells increases while number of valence electrons remains same.
- (a) How does the electropositive character of the element change on moving down the group?
- (b) Out of electropositive character, atomic size and number of valence electrons which property of elements increases along the period?
- (c) How the metallic character of elements varies across the period and down the group?

OR

What is the trend in nature of oxides of elements across period and down the group?

Solution

SCIENCE - 086

Class 10 - Science

1. The covalent compounds of carbon and hydrogen are called hydrocarbons.

Examples :

Methane : CH_4

Ethane : C_2H_6 or $\text{CH}_3 - \text{CH}_3$

Ethene : C_2H_4 or $\text{CH}_2 = \text{CH}_2$

Ethyne : C_2H_2 or $\text{CH} \equiv \text{CH}$

2. Molecular formula of first member : CH_2O

Molecular formula of second member : $\text{C}_2\text{H}_4\text{O}$

Molecular formula of third member : $\text{C}_3\text{H}_6\text{O}$

Thus, the general formula of the homologous series is $\text{C}_n\text{H}_{2n}\text{O}$. As successive member of this series differ by $-\text{CH}_2$ unit, thus they belong to the same homologous series. Also, chemical properties remain same for members of same homologous series as chemical properties solely depend on the functional group present.

OR

(i) C_4H_{10} (Butane)

(ii) C_6H_{12} (Hexene)

3. The benefits of using mechanical barriers such as condoms and diaphragms during sexual act are:-

(i) They prevent the deposition and entry of sperms in the female genital tract during copulation thus they serve as an effective method to avoid pregnancy.

(ii) They also protect against various sexually transmitted diseases likes AIDS, syphilis, etc.

4. If we breed a group of mice, all the progeny of mice will have tails just like their parents. Now, if we remove the tails surgically and again breed them, we still get new mice with tails. This is because cutting the tails of mice does not change the genes of their reproductive cells (or gametes). And since the acquired trait of 'cut tails' does not bring about a change in the genes of mice, this trait cannot be passed on to their next generations. From this, we conclude that the experiences acquired by an individual during his lifetime (called acquired traits) cannot be passed on to its progeny, and hence cannot lead to evolution because they are not caused by the change in genes.

5. Industrialisation is one main cause of deterioration of our environment. The main reasons are:

(i) Noise pollution: Pollution caused by machines in the factories disturbs the environment.

(ii) Industrial waste: It is the main cause of water pollution. Plastic, cans, aluminium etc. are highly toxic and major pollutants of our environment.

(iii) Poisonous gases: SO_2 , NO_2 and other toxic gases emitted by industries pollute the air.

(iv) Thermal pollution: It is caused by hot water released from factories. This hot water kills many aquatic plants and animals and thus affects aquatic flora and fauna.

(v) Acid rain: Oxides of nitrogen and sulphur emitted by industries cause acid rain. This rain damage historical monuments and pollutes water.

(vi) Radioactive wastes: Radioactive wastes are produced from nuclear reactors in the laboratories that cause great level of damage to the living organisms.

OR

Due to use of excessive fertilisers in the field, part of them are taken to lake during rainy season. Slowly, lake becomes enriched in phosphates and nitrates, due to which aquatic plants like algae in lake grow excessively. This phenomenon is called eutrophication. When surface of water body is completely covered, light and availability of dissolved oxygen is reduced which leads to death of fish.

6. (a) Although the atomic mass of O (16 u) is approximately an average (16.5 u) of the atomic masses of N (14 u) and F (19 u), i.e., $(14 + 19)/2 = 16.5$ but they cannot be regarded as a Döbereiner's triad because their properties are altogether different.

(b) Mendeleev left gaps for unknown elements and named them as *eka*-boron, *eka*-aluminium and *eka*-silicon, which after their discovery were named as scandium, gallium and germanium respectively.

OR

(a) Cl, Br and I form a Döbereiner's triad because atomic mass of Br is approximately equal to the average of the atomic mass of Cl and I. Although Mg, Ca and Sr have similar properties but the atomic mass of Ca (40 u) is not an average of the atomic masses of Mg (24.31 u) and Sr (87.62 u). Therefore, these elements do not constitute a Döbereiner's triad.

(b) In Mendeleev's periodic table, elements were arranged according to their similarities in properties hence, few elements with higher atomic masses were kept before elements with lower atomic masses.

The properties of cobalt are similar to those of rhodium and iridium (same group) and the properties of nickel are similar to those of palladium and platinum (same group).

7. (a) $P = \frac{V^2}{R}$

(b) Here, power of lamp, $P = 60 \text{ W}$; time, $t = 1 \text{ s}$

So, energy consumed = power \times time = $(60 \times 1) \text{ J} = 60 \text{ J}$

8. Pollination is the process of transfer of pollen grains from the anther of a flower to the stigma of the same or another flower. Pollen grains bear male gametes which are carried to the ovary of a flower with the help of pollen tubes. Hence, pollination brings male gametes in close proximity to the female reproductive part. Hence, if there is absence of pollination, male and female gametes will not occur on account of non-availability of male gamete.

OR

(i) The organisms, which reproduce by fragmentation are multicellular and have relatively simple body organisation, e.g., *Spirogyra*. They must have a single cell type of organisation that is capable of growing independently. Those organisms which are made up of different types of tissues and have complex body organisation cannot reproduce by fragmentation. The reason is that they are not simply a random collection of cells and cannot simply divide cell-by-cell.

(ii) If the cells/tissues are removed from the growth tip of a plant and placed in artificial media then they will divide to form a small group of cells or callus, which later differentiates to produce a large number of plantlets. These plantlets are then transferred to separate nursery or pots to obtain a large number of plants. It is called micropropagation. The three advantages of this technique are:

- (i) Rapid multiplication
- (ii) Production of virus free plants
- (iii) Plants propagated through this technique have genetic uniformity.

9. Mendel selected pea plant for breeding experiments because of the following features:

| S. No. | Feature | Advantage |
|--------|--------------|--|
| (i) | Annual plant | Short life cycle helped to study larger number of generations in shorter time. |

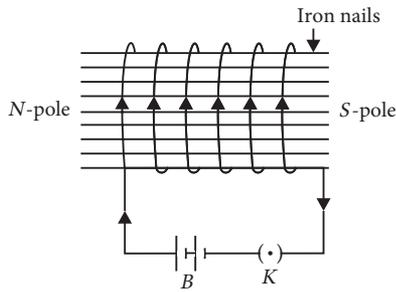
| | | |
|-------|------------------------|---|
| (ii) | Contrasting characters | Made analysis more convenient and reliable. |
| (iii) | Easy hybridisation | Artificial cross pollination is quite easy due to large reproductive structures. It helped in crossing pure plants with contrasting characters. |
| (iv) | Self fertility | Made possible to maintain homozygous pure lines for a particular character. |
| (v) | High number of seeds | Thus, sufficient number of progenies of each generation obtained. |

10. (a) Right-Hand Thumb Rule : Imagine the straight conductor in your right hand such that the thumb points in the direction of current. The direction of curling of fingers of the right hand gives the direction of magnetic field lines.

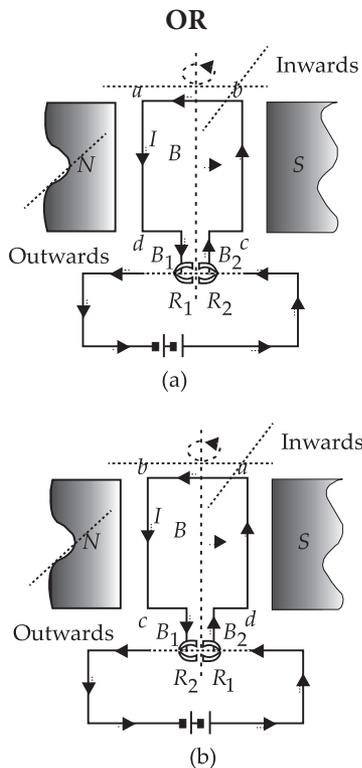
(b) Fleming's Left-Hand Rule : Stretch the thumb, the first finger and the central finger of the left hand so that they are mutually perpendicular to each other. If the first (fore) finger points in the direction of the magnetic field, the central finger points in the direction of current, then the thumb points in the direction of motion of the conductor (*i.e.*, direction of force on the conductor).

(c) Fleming's Right-Hand Rule (or Dynamo rule): Stretch the thumb, the first finger and the central finger of the right hand so that they are mutually perpendicular to each other. If the first (fore) finger points in the direction of magnetic field, the thumb points in the direction of motion of the conductor, then the central finger points in the direction of induced current.

11. (a) Take some iron nails of equal lengths. Wind an insulated copper wire around them so as to form a solenoid. Connect this solenoid to battery (B) and a key (K) as shown in figure. When the key is closed, current flows through the insulated copper wire and the nails inside the solenoid get magnetised, with one of their ends as north-pole and the other as south-pole. This arrangement becomes an electromagnet.



(b) The magnetism of soft iron inside the solenoid disappears immediately after switch off the current while steel does not and it becomes a permanent magnet. Therefore, core of electromagnet must be of soft iron but not steel.



An electric motor is a device for converting electric energy into mechanical energy. Thus, an electric motor is the reverse of an electric generator.

There are two types of electric motors : (i) AC motor and (ii) DC motor. We shall be describing here DC motor. The principle of a DC motor is very much different from that of an AC motor. It is important to remember that all the electric appliances like fan, air-conditioner, coolers, washing machines, mixers and blenders work on AC (house-hold power supply) and as such have AC motors installed in them.

Principle : When a coil carrying current, is placed in a magnetic field, it experiences a torque. As a result of this torque, the coil begins to rotate.

Construction : It consists of the following five parts:

1. **Armature :** The armature $abcd$ consists of a large number of turns of insulated copper wire wound over a soft iron core.
2. **Field Magnet :** The magnetic field B is supplied by a permanent magnet NS .
3. **Split-ring or Commutator :** These are two halves of the same metallic ring. The ends of the armature coil are connected to these halves which also rotate with the armature.
4. **Brushes or Sliding Contacts :** These are two flexible metal plates or carbon rods B_1 and B_2 which are so fixed that they constantly touch the revolving rings.
5. **Battery :** The battery consists of a few cells and is connected across the brushes. The brushes pass the current to the rings from where it is carried to the armature.

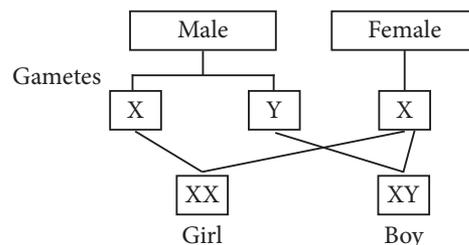
Split-ring in an electric motor takes the current from the battery and passes it on to the coil through the brushes after reversing its direction after every half revolution. The reversal of current in the coil reverses the direction of forces acting on the sides of the loop.

12. Sex is determined at the time of fertilisation when male and female gametes fuse. Male produces two types of gametes, *i.e.*, having X or Y chromosome and female produces same type of gametes containing X chromosomes. The sex of the child is determined at the time of fertilisation when male and female gametes fuse to form zygote.

If a sperm (male gamete) carrying X chromosome fertilises an egg or ovum (female gamete) carrying X chromosome, then the offspring will be a girl (female). This is because the offspring will have XX combination of sex chromosomes.

If a sperm (male gamete) carrying Y chromosome fertilises an egg or ovum (female gamete) which has X chromosome, then the offspring will be a boy (male). This is because the offspring will have XY combination of sex chromosomes.

Therefore, there are 50% chance of a male child and 50% chance of a female child.



13. The problem of waste disposal can be solved and reduced in the following manner:

(i) We should say no to plastic and other non-biodegradable materials and use disposable bags, plates and glasses made of paper and other materials of plant origin which are biodegradable.

(ii) All biodegradable domestic wastes should be dumped either in big pits specially dug up for this purpose or in low lying areas so that land reclamation could be brought about.

(iii) All non-biodegradable wastes such as metal, glass and plastic items should be segregated and handed over to authorities dealing with it. These items can be recycled.

14. (a) Household circuits over connected in parallel combination.

(b) A denotes series combination and B denotes parallel combination because in series combination, resistance is maximum and in parallel combination, resistance is minimum.

(c) In the given circuit, 3 Ω resistors are in series.

$$R_s = 3 + 3 = 6 \Omega$$

Now, R_s and 6 Ω are parallel.

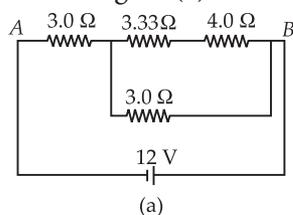
$$\frac{1}{R_p} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3} \Rightarrow R_p = 3 \Omega$$

OR

The 10 Ω and the 5.0 Ω are in parallel

$$R_{p_1} = \frac{(10 \Omega)(5.0 \Omega)}{10 \Omega + 5.0 \Omega} = 3.33 \Omega$$

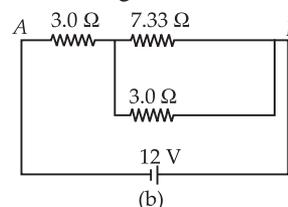
The circuit reduces to figure (a).



Now the 3.33 Ω and the 4.0 Ω are in series.

$$\therefore R_{s_1} = 3.33 \Omega + 4.0 \Omega = 7.33 \Omega$$

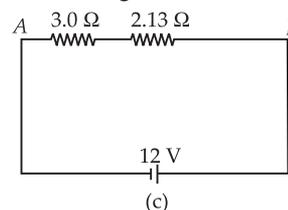
The circuit reduces to figure (b).



The 7.33 Ω and the 3.0 Ω are in parallel.

$$\therefore R_{p_2} = \frac{(7.33 \Omega)(3.0 \Omega)}{(7.33 \Omega + 3.0 \Omega)} = 2.13 \Omega$$

The circuit reduces to figure (c).



Finally, the 2.13 Ω and the 3.0 Ω are in series.

The equivalent resistance between A and B is

$$R = 2.13 \Omega + 3.0 \Omega = 5.13 \Omega$$

15. (a) As the size of the atom increases down the group, electropositive character increases.

(b) As we move from left to right along a period, the number of valence electrons increases from 1 to 8.

(c) Metallic character is defined as the tendency to lose electron. Metallic character decreases along the period because of the increasing effective nuclear charge from left to right in a period. While on moving down the group metallic character increases because of the decrease in effective nuclear charge.

OR

Metals form basic oxides and non-metals form acidic oxides. As on moving across the period metallic character decreases thus acidic nature of oxides increases. While on moving down the group metallic nature of elements increases thus basic character of oxides also increases.