Sample Question Paper - 11
Science (086)
Class- X, Session: 2021-22
TERM II

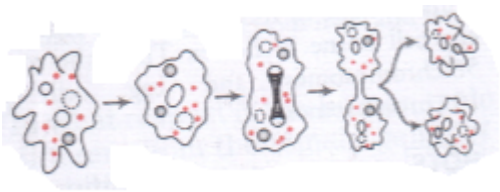
Time Allowed: 2 hours **Maximum Marks: 40**

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. The atomic number of nitrogen (N), oxygen (O) and fluorine (F) are 7,8 and 9 respectively. **[2]**
   i. What is the number of valence electrons in N and F?
   ii. Name the element having smallest and largest atomic radii of any of the above three elements. Give reason for your answer.
3. Study the diagram given below: **[2]**

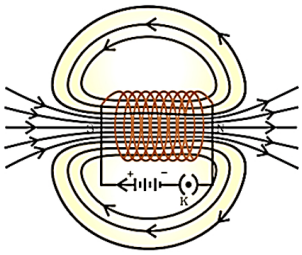


   i. Identify the process.
   ii. Which organism uses the above method for reproduction?
   iii. How is the above method different from the process of fragmentation?
4. Give one example of each. **[2]**
   (i) mechanical methods of contraception
   (ii) chemical methods
5. i. In humans, if gene B gives brown eyes and gene b gives blue eyes, what will be the colour of eyes of the persons having the following combination of genes? (a) Bb (b) bb (c) BB **[2]**
   ii. What do you class this trait of eye colour in human? Explain.

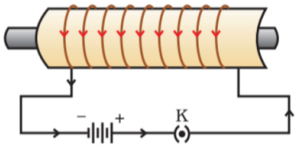
   OR

   Why did Mendel choose garden pea for his experiments?
6. An insulated copper wire wound on a cylindrical cardboard tube such that its length is greater **[2]**

than its diameter is called a solenoid. When an electric current is passed through the solenoid, it produces a magnetic field around it. The magnetic field produced by a current-carrying solenoid is similar to the magnetic field produced by a bar magnet.



Field lines of the magnetic field through and around a current-carrying solenoid.



A current-carrying solenoid coil is used to magnetize steel rod inside it-an electromagnet.

i. What will be the strength of the magnetic field inside a long current-carrying straight solenoid?

ii. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is double and the number of turns per cm is halved, then new value of magnetic field?

7. Why is damage to the ozone layer a cause for concern? What steps are being taken to limit this damage? **[2]**

Section B

8. Taking the example of an element of atomic number = 16, **[3]**

i. Explain, how the electronic configuration of the atom of an element relates to its position in the modern periodic table?

ii. How valency of an element is calculated on the basis of its atomic number?

9. i. In what form/forms does Carbon exists in the atmosphere? **[3]**

ii. What is the structural formula of ethyne?

OR

i. Define covalent bond. Explain with the help of examples.

ii. What would be the electron dot structure of a molecule of sulphur which is made up of eight atoms of sulphur?

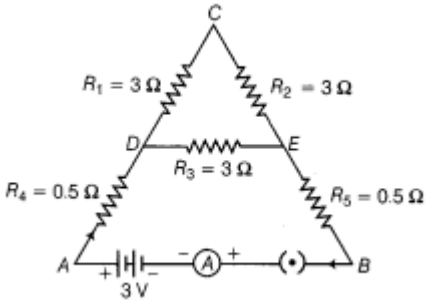
10. A teacher was showing a video on different animals when Varun observed the similarities in sharks and dolphins about shape of body, fins and. flippers. He classified both of them as homologous to each other. Is he right? Give reasons in support of your answer. **[3]**

11. i. It would cost a man ₹3.50 to buy 1.0 kW h of electrical energy from the Main Electricity Board. His generator has a maximum power of 2.0 kW. The generator produces energy at this maximum power for 3 hours. Calculate how much it would cost to buy the same amount of energy from the Main Electricity Board. **[3]**

ii. A student boils water in an electric kettle for 20 minutes. Using the same mains supply he wants to reduce the boiling time of water. To do so should he increase or decrease the length of the heating element? Justify your answer.

12. Five resistors are connected in a circuit as shown in figure. Find the ammeter reading when **[3]**

the circuit is closed.

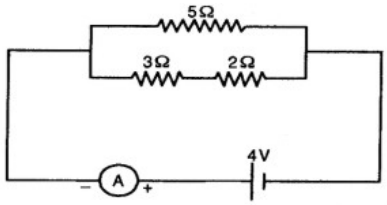


OR

In a circuit find

i. total resistance

ii. current shown by ammeter.



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]**

Sex determination is the method by which distinction between males and females is established in a species. The sex of an individual is determined by specific chromosomes. These chromosomes are called sex chromosomes or allosomes. X and Y chromosomes are called sex chromosomes. The normal chromosomes other than the sex chromosomes of an individual are known as autosomes.

i. In XX-XY type of sex determination who produces two different types of gametes?

ii. A couple has six daughters. What is the possibility of their having a girl next time?

iii. What is the number of autosomes present in the liver cells of a human female?

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 insulated copper wire wound on a cylindrical cardboard tube such that its length is greater than its diameter is called a solenoid. When an electric current is passed through the solenoid, it produces a magnetic field around it. The magnetic field produced by a current-carrying solenoid is similar to the magnetic field produced by a bar magnet. The field lines inside the solenoid are in the form of parallel straight lines. The strong magnetic field produced inside a current-carrying solenoid can be used to magnetise a piece of magnetic material like soft iron,

when placed inside the solenoid. The strength of magnetic field produced by a current carrying solenoid is directly proportional to the number of turns and strength of current in the solenoid.

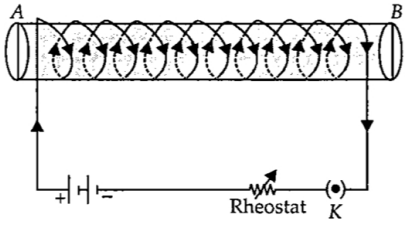
i. What would be the strength of the magnetic field inside a long current-carrying straight solenoid?

ii. By using which rule we can find the north-south polarities of an electromagnet?

iii. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is double and the number of turns per cm is halved, then what will be the new value of magnetic field?

OR

A soft iron bar is enclosed by a coil of insulated copper wire as shown in figure. When the plug of the key is closed, then where would the face B of the iron bar be marked?



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. Valence electrons of Nitrogen (N) are 5
   Valence electrons of Fluorine (F) are 7
   ii. Smallest radius is of fluorine (F), largest radius is of nitrogen (N). Atomic radius decreases on moving left to right across a period due to increase in the force of attraction between nucleus and valence electrons as the number of electrons and protons increases on moving from left to right in a group.
3. i. The process depicts binary fission, a method of asexual reproduction. Involving single parent only. Where the parent cell grow and divide into 2 daughter cell.
   ii. Binary fission is observed in unicellular organisms or multicellular organism with simple body design, such as Amoeba, Euglena and Paramecium, etc.
   iii. Differences between fission and fragmentation are:

Fission	Fragmentation
It is the division of parent body into two identical daughter cells of similar size.	It is the division of parent body into two or more small fragments. Which regrow into new organism.
It occurs in unicellular organisms or multicellular organisms with simple body organisation.	It occurs only in multicellular organisms with complex cellular organisations.
e.g. Amoeba, plasmodium.	e.g. Spirogra.

4. **Mechanical**: Condoms in males and diaphragm in female.
   Chemical: Use of oral pills.
5. i. Bb will have brown eyes.
   bb will have blue eyes.
   BB will have brown eyes.
   ii. Eye colour in humans is an inherited trait. These are traits that are present in the DNA of an organism and are passed on to their progeny.

   OR

   Mendel selected pea plant (Pisum sativum) because:
   i. Many varieties were available with observable alternative forms for a trait or characteristic.
   ii. Peas are normally self pollinated: as their corolla completely enclose the reproductive organs until pollination is completed.
   iii. It was easily available.
   iv. It has pure lines for experimental purpose, i.e. they always breed true.
   v. It has contrasting characters. The traits were seed colour, pod colour, pod shape, flower shape, position of flower, seed shape and plant height.
   vi. Its life cycle was short and produced large number of offsprings.
   vii. The plant is grown easily and does not require care except at the time of pollination.
6. i. Magnetic field inside infinite solenoid is uniform. Hence it is same at all points.
   ii. For a long solenoid, magnetic field $B \propto In$; where I is the flowing current and n is number of turns per unit length in the solenoid. Therefore, in the given case magnetic field will remain unchanged.
7. Ozone layer acts as a protective shield against the harmful Ultraviolet rays of the sun. Depletion of ozone layer leads to exposure to Ultraviolet rays & due to this the incidences of cancer, cataract are on rise. Also the uv rays damage the immune system of human beings.
   In 1987, United Nations Environment Programme (UNEP) succeeded in forging an agreement between nations to freeze chlorofluorocarbons (CFCs) production to 1986 levels. CFCs are the main cause of ozone layer depletion.

Section B

8. The element with atomic number 16 (sulphur) has the following electronic configuration:
   $S^{16} = \frac{K}{2,}\ \frac{L}{8,}\ \frac{M}{6}$
   Since, it has 6 electrons in its outer shell, hence it is placed in group 16 (VI A) of modern periodic table. Valency of an element is calculated considering nearest noble gas (He, Ne, Ar etc.) or octet configuration. As in this case, the nearest noble gas is argon (Ar), hence sulphur needs 2 more electrons to gain stability. Hence, its valency is 2 where as it has 6 valance electron. The period in which the element is positioned is related to number of orbits in which electrons are kept, in the case of sulphur it is kept in third period because it has 3 shells.
9. i. Carbon dioxide only Carbon exists in the atmosphere in the form of carbon dioxide gas (CO_2) in the air (only 0.03%). Carbon also occurs in the earth's crust in the form of minerals likes carbonates. It also occurs in the form of fossil fuels, organic compounds, wood, cotton, and wool, etc.
   ii. H - C ≡ C - H as the formula of ethyne is C_2H_2

OR

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 :

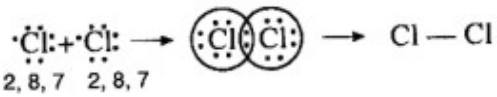
Element	At no.	Electronic configuration
H	1	1
C	6	2,4
O	8	2, 6
N	7	2, 5

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:

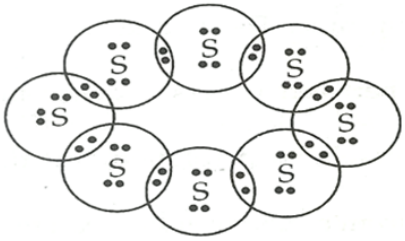


Formation of Cl_2 molecule

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. Electron dot structure of a molecule of sulphur (S_8)

Atomic number of Sulphur is 16 and the electronic configuration is 2, 8, 6. The number of valence electrons is 6 and a sulphur atom requires 2 more electrons to complete an octet. A sulphur atom achieves the octet by sharing one electron each with two other sulphur atoms. Thus, 8 sulphur atoms form a cyclic octa-atomic molecule with formula S_8.



10. The organs which are inherited from a common ancestor and which contains same basic structure, but perform different functions in different organisms is called Homologous organs.
Ex: forelimbs of humans, bird and bats are all homologous organs.
The similarities seen in sharks and dolphins such as the shape of body, fins and flippers have all evolved independently.So, they are analogous organs.
So, we can say that Varun is wrong.

11. a. E = P × T
So, E = 3 × 2 = 6 kWh
Cost of buying electricity from the main electricity board = 6 × 3.50 = ₹21.0

b. To reduce the boiling time using the same mains supply, the rate of heat production should be large. We know that P = $\frac{V^2}{R}$. Since V is constant, R should be decreased. Since R is directly proportional to l so length should be decreased.

12. R_1 and R_2 are in series,
$R_s = R_1 + R_2 = 3 + 3 = 6\ \Omega$
R_S and R_3 are in parallel.
$\therefore \quad \frac{1}{R_p} = \frac{1}{R_S} + \frac{1}{R_3}$
$= \frac{1}{6} + \frac{1}{3} = \frac{1}{2}$
$\Rightarrow R_P = 2\ \Omega$

R_4, R_P, R_5 are in series,

$\therefore R_{S'} = R_4 + R_P + R_5 = 0.5 + 2 + 0.5 = 3\ \Omega$

Current, I = $\frac{V}{R_{S'}} = \frac{3}{3} = 1A$

OR

Resistors 3Ω and 2Ω are in series
The effective resistance of lower arm = 3 + 2 = 5 Ω
Resistance of upper arm is also 5Ω. The lower and upper arms are in parallel to each other.
Therefore, the total resistance is given by
$\frac{1}{R} = \frac{1}{5} + \frac{1}{5} = \frac{2}{5}$, $R_t = \frac{5}{2} = 2.5\ \Omega \ldots\ldots\ldots\ldots (i)$
The current through ammeter is equal to the total current.
$\therefore$ Total current = $\frac{V}{R_t} = \frac{4}{2.5} = \frac{40}{25} = \frac{8}{5} = 1.6\ A$

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. males produce two different types of gametes
In XX-XY type of sex determining mechanisms, males produce two different types of gametes, either with or without X-chromosome (XO type), or some gametes with X-chromosome and some with Y-chromosome (XY type). Such type of sex determination mechanism is designated to be the example of male heterogamety. In both, females are homogametic and produce X type of gametes in both the cases and have XX genotype.

ii. 50%
The possibility of having a girl or boy child is equal i.e., 50%, as 50% male gametes are Y type and 50% are X type. Fusion of egg with X type sperm will produce a girl child.

iii. 22 pairs
In humans, the number of autosomes are 2n = 44 or 22 pairs regardless of the sex.

15. i. Magnetic field inside infinite solenoid is uniform. Hence it is same at all points.

ii. Clock face rule

iii. For a long solenoid, magnetic field $B \propto In$; where I is the flowing current and n is number of turns per unit length in the solenoid. Therefore, in the given case magnetic field will remain unchanged.

OR

N-pole