Sample Question Paper - 36
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. Nitrogen (atomic number 7) and phosphorus (atomic number 15) belong to group 15 of the periodic table. Write their electronic configuration. Which of these will be more electronegative and why?

2. (a) Which two of the following compounds belong to same homologous series?
$C_2H_6O_2$, C_2H_6O, C_2H_6, CH_4O

(b) The formula of a hydrocarbon is C_nH_{2n-2}. Name the family to which it belongs. Write the structure of second member of this series.

3. There are various agents which help in transfer of pollen grains from anther of one flower to stigma of another flower. How do insects help in this?

4. At an age of 11-12 years in girls, various hormonal changes occur resulting in changes in reproductive organ and also secondary sexual characters. Enlist such changes seen in girls at the time of puberty.

5. A trait *A* exists in 30% of a population of a species and a trait *B* exists in 70% of the same population. Which trait is likely to have arisen earlier?

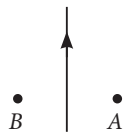
OR

"It is a matter of chance whether a couple will have a male or a female child." Justify this statement by drawing a flow chart.

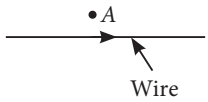
6. Describe Oersted experiment.

OR

(a) A current is flowing in upward direction on the plane of paper. Find the direction of magnetic field at *A* and *B*.



(b) What is the direction of magnetic force on an electron kept at a point *A* above the wire carrying current *I* as shown in the figure?

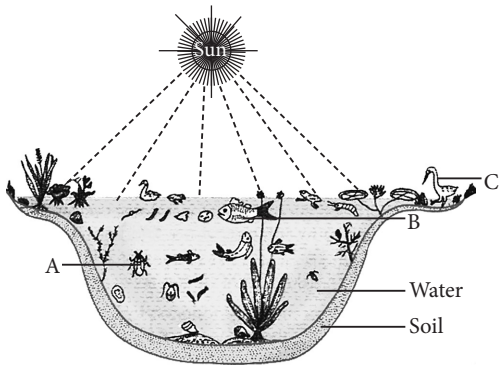


7. Write the common food chain of a pond ecosystem.

OR

(a) In a food chain consisting of rabbit, snake and peacock, identify the primary, secondary and tertiary consumers.

(b) Label A, B and C in the given diagram with their trophic levels.



SECTION - B

8. What will be the formula and electron dot structure of cyclopentane?

9. (a) What property do all elements in the same column of the periodic table as that of boron have in common?

(b) Discuss the variation of valency along a given period.

OR

The positions of three elements *A*, *B* and *C* in the periodic table are shown below :

Group 16	Group 17
–	–
–	*A*
–	–
B	*C*

(a) State whether *A* is metal or non-metal.

(b) Will *C* be larger or smaller in size than *B*?

(c) Which type of ion, cation or anion will be formed by the element *A*?

10. (a) On crossing two heterozygous tall plants (Tt), a total of 500 plants were obtained in F_1 generation. What will be the respective number of tall and dwarf plants obtained in F_1 generation?

(b) How many pairs of contrasting traits were studied by Mendel in pea plant?

11. A bulb is rated 40 W; 220 V. Find the current drawn by it, when it is connected to a 220 V supply. Also find its resistance. If the given bulb is replaced by a bulb of rating 25 W; 220 V, will there be any change in the value of current and resistance? Justify your answer and determine the change.

12. Draw a schematic diagram of a circuit consisting of a battery of three cells each of 2V, a combination of three resistors of 10 Ω, 20 Ω and 30 Ω connected in parallel, a plug key and an ammeter, all connected in series. Find the value of current through each resistor?

OR

Show how would you join three resistors, each of resistance 9 Ω so that the equivalent resistance of the combination is (a) 13.5 Ω, (b) 6 Ω?

13. Suppose you find a heap of domestic waste, in a nearby park, which is decomposing. What would you do to make the people of the surrounding area realise that such type of disposal of domestic waste is harmful to the environment?

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. To study pattern of inheritance, Mendel crossed pea plants with contrasting characters and observed that one of the parental forms of trait was always absent in F_1 hybrid but reappeared unchanged in the F_2 generation.

(a) Work out a cross upto F_2 generation between two pure breed pea plants, one bearing violet flowers and the other white flowers.

(b) Name this type of cross.

(c) State the different laws of Mendel that can be derived from such a cross.

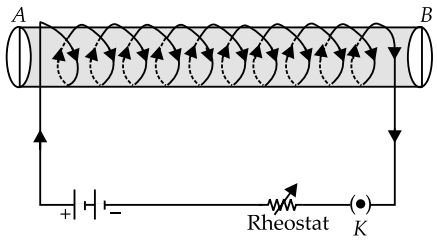
OR

Plant with round seeds is crossed with plant having wrinkled seeds. All F_1 progenies are with round seeds. What percentage of plants would have wrinkled seeds in F_2 generations?

15. 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 per unit length and strength of current in the solenoid.

(a) 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 find the value of new magnetic field.

(b) 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, which pole will appear on the face *B* of the iron bar?



(c) When is a magnetic field said to be uniform? Draw magnetic lines of force for the uniform magnetic field.

OR

Describe an activity with a neat diagram to show the magnetic field line around a bar magnet.

Solution

SCIENCE - 086

Class 10 - Science

1. The electronic configurations of the two elements are :

Nitrogen ($Z = 7$) : 2, 5 ; Phosphorus (Z = 15) : 2, 8, 5

Nitrogen is more electronegative than phosphorus as the electronegativity decreases down the group with increase in size.

2. (a) Two members of a homologous series differ from each other by — CH_2 group. Hence, CH_4O and C_2H_6O belong to same homologous series.

(b) The hydrocarbon belongs to alkyne family. The second member of alkyne family is $CH_3—C \equiv CH$.

3. When pollination (transfer of pollen grain from anther to stigma) is done by insects, it is known as entomophily. When an insect visits a flower for nectar (honey), the pollen grains get deposited on the body of insect. When this insect visits another flower, then some of the pollen grains shed off and stick to the stigma of another flower, this leads to pollination.

4. The changes that are seen in girls at the time of puberty, at an age of 11-12 years are :

(i) Growth of breasts and external genitalia (vulva)

(ii) Growth of pubic hair

(iii) Broadening of pelvis

(iv) Initiation of menstruation and ovulation

(v) Increase in the subcutaneous fat, particularly in thighs, shoulders, buttocks and face.

5. During reproduction, variations occur and accumulate. Variations occurring in first generation will be inherited to subsequent generations, thus should be more frequent. Here trait B occurs in more individuals thus, it is likely to have arisen earlier.

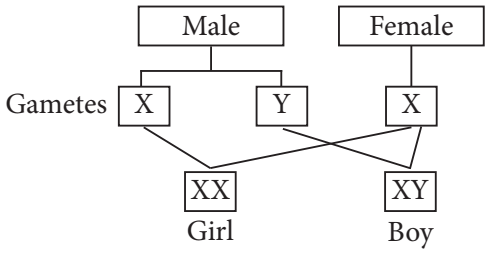
OR

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

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), with XX combination of sex chromosomes.

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

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



6. In his experiment Oersted observed that when an electric current flows in a wire, the needle of the compass deflects. Now, a magnet can be deflected by the magnetic effect of other element only. So, Oersted concluded that an electric current flowing in a wire created a magnetic field which deflected the needle of the compass.

OR

(a) At *A*, perpendicular to the plane of paper downwards.

At *B*, perpendicular to the plane of paper upwards.

(b) At *A*, magnetic field is perpendicular to the plane of paper upwards. Since, electron is at rest, no force will act on electron.

7. The sequential interlinking of organisms involving transfer of food energy from the producers, to top consumer through a series of organisms with repeated eating and being eaten is called the food chain. A pond is a classical example of an aquatic ecosystem. A common food chain of a pond ecosystem can be shown as :

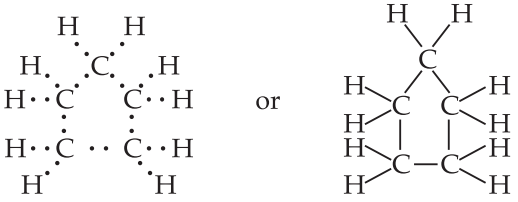
Phytoplanktons → Small aquatic animals → Small fish → Water birds (zooplankton, larvae of insects, etc.)

OR

(a) Rabbit is the primary consumer because it directly feeds upon producers. Snake is the secondary consumer because it preys upon primary consumer, *i.e.*, rabbit. Peacock is the tertiary consumer because it feeds upon secondary consumer *i.e.* snake.

(b) A. Primary consumer (T_2) – Zooplankton
B. Secondary consumer (T_3) – Fish
C. Tertiary consumer (T_4) – Fish eating bird

8. Cyclopentane is a cyclic compound with formula C_5H_{10}. The structure of the compound may be represented as :



9. (a) All the elements which lie in the same column as that of boron belong to group 13. Therefore, they have three electrons in their respective valence shells. Except boron, which is a non-metal, all other elements (*i.e.*, aluminium, gallium, indium and thallium) in this group are metals.

(b) On moving from left to right in a period, the number of valence electrons increases from 1 to 8 (though in the first period, it increases from 1 to 2). As we move across the period, the valency of elements first increases from 1 to 4 and then decreases to 0. In a period, the valency of an element is either equal to number of electrons in a valence shell or eight minus the number of electrons in the valence shell.

OR

(a) Group 17 represents halogen family. All the elements included in the family are non-metals. Therefore, element *A* is a non-metal.

(b) Atomic size of the elements decreases along a period. The elements *B* and *C* are present in the same period. Since *C* is placed after *B*, the size of the element *C* is less than that of *B*.

(c) The element *A*, as pointed out earlier is a non-metal which belongs to group 17. It has seven valence electrons (2, 8, 7). In order to have the configuration of the nearest noble gas element, it will take up one electron and change to anion *i.e.,* A^- ion.

10. (a) The crossing between two heterozygous (Tt) plants would give phenotypic ratio of 3 tall : 1 dwarf.

Parents T t × T t

Gametes T t T t

F_1 generation :

♂ / ♀	T	t
T	TT (Tall)	Tt (Tall)
t	Tt (Tall)	tt (Dwarf)

If total plants obtained were 500, then the number of tall and dwarf plants will be

Tall plants = $\frac{3}{4} \times 500 = 375$

Dwarf plants = $\frac{1}{4} \times 500 = 125.$

(b) 7 pairs of contrasting traits were studied by Mendel in pea plant.

11. In first case, $P = 40$ W, $V = 220$ V

Current drawn, $I = \frac{P}{V} = \frac{40}{220} = 0.18$ A

Also, resistance of bulb, $R = \frac{V^2}{P} = \frac{(220)^2}{40} = 1210\ \Omega$

In second case, $P = 25$ W, $V = 220$ V

Current drawn, $I = \frac{P}{V} = \frac{25}{220} = 0.11$ A

Also, resistance of the bulb, $R = \frac{V^2}{P} = \frac{(220)^2}{25} = 1936\ \Omega$

Hence, replacing a 40 W a bulb by a 25 W bulb, across the same source of voltage, the amount of current decreases while resistance increases.

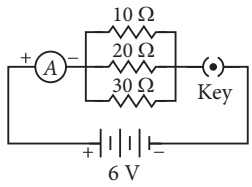
Change in current,

$\Delta I = 0.18 - 0.11 = 0.07\ A$

Change in resistance,

$\Delta R = 1936 - 1210 = 726\ \Omega$

12. The circuit diagram is as shown below.



Given, voltage of the battery (V) = 2V + 2V + 2V
= 6 V

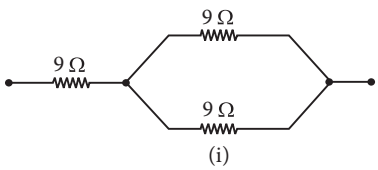
Current through 10 Ω resistance, $I_{10} = \frac{V}{R} = \frac{6}{10} = 0.6$ A

Current through 20 Ω resistance, $I_{20} = \frac{V}{R} = \frac{6}{20} = 0.3$ A

Current through 30 Ω resistance, $I_{30} = \frac{V}{R} = \frac{6}{30} = 0.2$ A

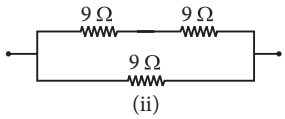
OR

(a) The resistance of the series combination is higher than each of the resistances. A parallel combination of two 9 Ω resistors is equivalent to 4.5 Ω. We can obtain 13.5 Ω by coupling 4.5 Ω and 9 Ω in series. So, to obtain 13.5 Ω, the combination is as shown in figure (i).



(i)

(b) To obtain an equivalent resistance of 6 Ω, we have to connect two 9 Ω resistors in series and then connect the third 9 Ω resistor in parallel to the series combination as shown in the figure (ii).



(ii)

13. Some of the ways to make people realise that the improper disposal of waste is harmful to the environment includes making people aware of negative impacts of waste disposal. They can be made aware by :

(i) Conducting seminars about the negative effects of the wastes on environment.

(ii) Usage of pamphlets and posters for providing information.

(iii) Forming an eco-club in the society for spreading awareness about the ill-effects of waste on the surroundings such as : Improper disposal of waste will release harmful gases in the environment that make it unclean and unhygienic for the living organisms. The waste will flow to water bodies along with rain water and become a threat to aquatic life and pollute the water bodies. It provides space for breeding of the mosquitoes and results in spread of malaria, filariasis, dengue, etc. Hazardous chemicals from wastes get into the soil and can harm the plants when they take up the contamination through their roots.

14. (a) In pea plant, violet flower colour is dominant over the white colour. The cross between the two can be shown as :

Parents : Violet flower × White flower

Genotype : PP pp

Gametes : (P) (p)

F_1 generation : (Pp)

Violet flower

Selfing

F_2 generation :

♂ \ ♀	P	p
P	PP	Pp
p	Pp	pp

Violet flower : White flower

3 : 1

(b) Cross involving only 1 pair of contrasting factors is called monohybrid cross.

(c) Mendel's law of dominance and law of segregation can be derived from this cross. Law of dominance states that when individuals differing in a pair of contrasting characters are crossed, the character that appears in the F_1 hybrid is dominant over the alternate form that remain hidden. Principle of segregation states that, "when a pair of contrasting factor or gene are brought together in a hybrid; these factors do not blend or mix up but simply associate themselves and remain together and separate at the time of gamete formation", *i.e*, allele pairs segregate during gamete formation and the paired condition is restored by random fusion of gametes during fertilisation.

OR

Punnett square for the given experiment.

Parents : RR Round seed × rr Wrinkled seed

Gametes : R r

F_1 : Rr (Round)

Selfing : Rr × Rr

F_2 :

♀ \ ♂	R	r
R	RR Round	Rr Round
r	Rr Round	rr Wrinkled

Genotypic ratio : RR : Rr : rr

1 : 2 : 1

So, 25% of plants would have wrinkled seeds in F_2 generation.

15. (a) : 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.

New magnetic field $B' \propto I'n'$

Given $I' = 2I$

$$n' = \frac{n}{2}$$

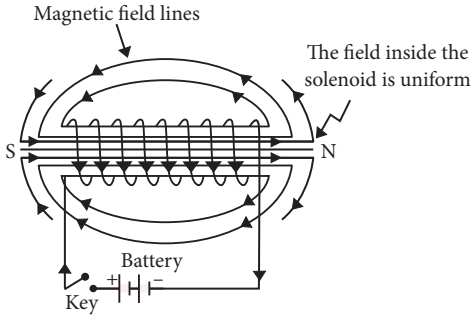
Now, $\frac{B}{B'} = \frac{In}{I'n'}$

$\Rightarrow \quad \frac{B}{B'} = \frac{In}{2I \times \frac{n}{2}}$

$\Rightarrow \quad B' = B$

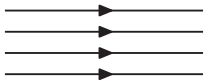
Therefore, in the given case magnetic field will remain unchanged.

(b) The direction of field lines due to solenoid is shown in figure



The soft iron bar will be magnetised due to these fields and will have same direction as due to solenoid. So north pole will appear on the face *B* of the iron bar.

(c) A magnetic field is said to be uniform if its magnitude and direction do not change. For magnitude to remain constant the spacing between the lines should be equal. For direction to be same, the lines should be parallel.



OR

The magnetic field pattern due to a bar magnet can be plotted by using a compass.

Firstly, place a compass needle near to the North pole of the magnet and mark the position of the ends N and S of compass needle.

Like poles repel each other. So the North pole of the compass needle stays away from the North pole of the magnet.

Then move the compass until the end of the compass is over the second dot and mark the new position of the other with a third dot.

Repeat the above step until reaching the other pole. Then join these series of dots and this will give a magnetic field line. Using this method other field lines can also be drawn.