Sample Question Paper - 29
Science (086)
Class- X, Session: 2021-22
TERM II

Time allowed : 2 hours ***Maximum marks : 40***

General Instructions :

(i) All questions are compulsory.

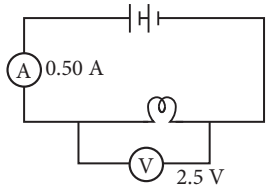
(ii) The question paper has three sections and 15 questions. All questions are compulsory.

(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.

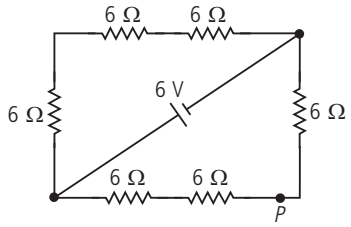
(iv) Internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

SECTION - A

1. In the circuit shown, the reading of the ammeter is 0.50 A and the reading of the voltmeter is 2.5 V. Calculate the energy dissipated in the lamp in 15 s.

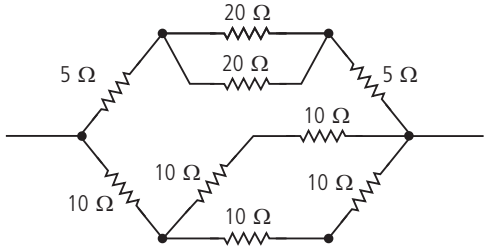


2. Six 6 Ω resistors are connected to a 6 V cell of negligible internal resistance as shown below. What is the current that flows through point *P*?



OR

What is the effective resistance of the nine resistors shown in the given circuit?



3. Explain the following :

(a) Why are the conductors of electric heating devices, such as toasters and electric ions, made of an alloy rather than a pure metal?

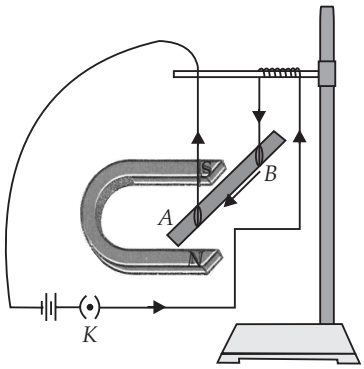
(b) Why are copper and aluminium wires usually employed for electricity transmission?

4. In an activity demonstrating the force acting on a current-carrying conductor placed in a magnetic field as shown in figure, how do we think the displacement of rod *AB* will be affected if

(a) current in rod *AB* is increased?

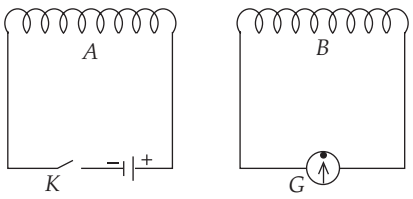
(b) a stronger horse-shoe magnet is used?

(c) length of the rod *AB* is increased?



OR

Two coils *A* and *B* are placed as shown in figure. The coil *A* is connected to a battery and a key *K* while the coil *B* is connected to a centre zero galvanometer *G*. What will you observe in the galvanometer *G* when



(a) the key *K* is closed.

(b) the key *K* is opened.

5. What is the principle of an electric motor and what is the role of the split ring in an electric motor?

6. Describe an activity to demonstrate the pattern of magnetic field lines around a straight conductor carrying current.

7. Ecosystem is a self regulated and self sustaining structural and functional unit of biosphere consisting of a community of living beings and its physical environment, both interacting and exchange materials between them. List the fundamental steps in the operation of an ecosystem.

OR

CO_2 is a one of the greenhouse gas which has 60% warming effect in the atmosphere. Increase in concentration of greenhouse gases leads to increase in average global temperature, it is called global warming. Suggest few measures for controlling carbon dioxide levels in the atmosphere.

SECTION - B

8. Ethanol is an organic compound found in alcoholic drinks.

(a) How many different types of elements are there in ethanol?

(b) (i) How many valence electrons are there in one molecule of ethanol?

(ii) Identify the type of bonds and number of bonds in ethanol.

9. How do the following properties change down the group and along the period? Briefly explain.

(a) Valency

(b) Atomic size

(c) Electropositive character

OR

Element Y is given the chemical symbol ${}^{40}_{20}Y$.

(a) What is the electronic configuration of element Y?

(b) Determine the position of element Y in the periodic table.

(c) Explain how an atom of element Y can form an ion.

10. 'Regeneration cannot be regarded as reproduction'. Why?

11. Name the mode of reproduction that ensures variation in the offsprings. What mechanism, do you think, is actually responsible for variation leading to the survival of the species?

OR

(a) What is the difference between genetics and heredity?

(b) Write the contribution of Gregor Mendel in the modern genetics.

12. Reproduction means that the living organisms produce young ones of their own kind. Thus, it creates new life and is essential for existence and continuity of a species.

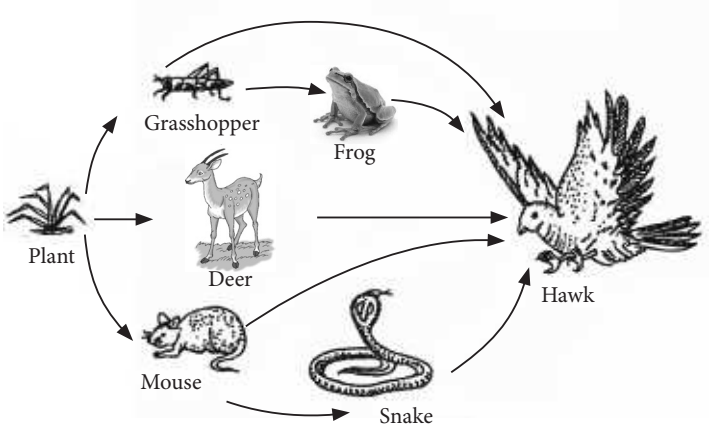
Give reasons for the following:

(a) Scrotum remains outside the body of human males.

(b) Petals of flowers are brightly coloured.

(c) Some plants are propagated only by vegetative methods.

13. Study the given food web through which energy passes in the ecosystem.



(a) How many food chains are shown in the given figure ?

(b) Write down two characteristics of the interaction shown in the figure.

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. Read the passage given below and answer the questions :

Two allotropic forms of carbon which are crystalline in nature, are diamond and graphite. They differ physically but chemically they are similar. Diamond is the hardest crystalline form of carbon. In diamond,

each carbon atom is linked to four other carbon atoms by covalent bonds. In graphite, each carbon atom is linked to three other carbon atoms by covalent bond. Graphite is relatively soft and greasy. It is also a good conductor of electricity. The C — C bond length in graphite is 141.5 pm while in diamond it is 154 pm.

(a) Which type of bonds are present in the diamond's structure?

(b) Why is graphite a good conductor of electricity?

(c) Why is diamond hardest crystalline form of carbon?

OR

Draw a neat and labelled structure of diamond?

15. In mice, black coat colour (allele B) is dominant to brown coat colour (allele b). The offspring of a cross between a black mouse (BB) and a brown mouse (bb) were allowed to interbreed.

(a) Work out cross upto F_2 generation for such interaction.

(b) What percentage of the progeny in F_2 generation would have black coats?

(c) If a heterozygous black mouse is crossed with a recessive parent then what would be the ratio of their progenies?

OR

If a heterozygous black mouse is crossed with its homozygous parent, then what percentage of the progeny would have black coats? Name the term given to this type of cross.

Solution

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1. Charge, Q = Current (I) × time (t)

Energy dissipated = Potential difference × Charge

$\therefore \quad E = V \times Q = V \times I \times t$

or $\quad E = 2.5 \times 0.50 \times 15 = 18.75$ J

2. The 6 V cell is connected in parallel with the top 18 Ω (6 Ω + 6 Ω + 6 Ω) and the bottom 18 Ω (6 Ω + 6 Ω + 6 Ω). The voltage across the bottom 18 Ω resistor is 6 V.

Current through point P

$= V/R$

= 6 V / 18 Ω = 0.33 A

OR

Combined resistance of the two 10 Ω resistors in parallel with another two 10 Ω resistors is 10 Ω.

$\therefore$ Combined resistance of the bottom five 10 Ω resistors = 20 Ω

Combined resistance of the two 20 Ω resistors in parallel is 10 Ω

$\therefore$ Combined resistance of the topmost 4 resistors (5 Ω, 20 Ω, 20 Ω, 5 Ω) = 20 Ω.

The effective resistance of the whole circuit (two 20 Ω resistors in parallel) = 10 Ω.

3. (a) The resistivity of an alloy is generally higher than that of pure metals of which it is made of.

(b) Copper and aluminium wires possess low resistivity and as such are generally used for electricity transmission.

4. The displacement of the rod AB

(a) will increase when the current in rod AB is increased.

(b) will increase when a stronger horse-shoe magnet is used.

(c) will increase when length of the rod AB is increased.

OR

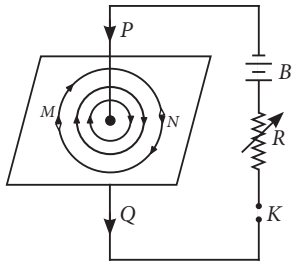
(a) As the key K is closed, a deflection is observed in the galvanometer for a short while (*i.e.* a momentary deflection). In other words, the galvanometer needle deflects and return to zero.

(b) As the key K is opened, again a momentary deflection (but more) is observed in the opposite direction.

5. An electric motor is based upon the magnetic effect of current. When an electric current is passed through a conductor placed at right angle to a magnetic field, a force perpendicular both to the magnetic field and the conductor acts on it. This makes the conductor move. The direction of motion of the conductor is given by Fleming's left-hand rule.

The role of split ring is to change the direction of current flowing through the coil after each half-rotation.

6. Pass a straight vertical conductor (an insulated copper wire) PQ through a smooth cardboard placed horizontally as shown in the figure. Connect the ends of the wire with a battery B, a variable resistor R and a key K. Sprinkle some iron filings on the smooth cardboard uniformly. Now, switch on the key K. A current flows from Q to P. As the current flows from Q to P, the iron filing rearrange in the form of concentric circles with the centre of the circles at the point where the wire passes the cardboard.



7. The fundamental steps in the operation of an ecosystem can be arranged in the following order:

(i) Reception of energy by autotrophs (producers).

(ii) Synthesis of organic materials by producers.

(iii) Consumption of these materials by consumers.

(iv) Decomposition of dead and decaying materials by decomposers and transformation of substances into nutrients to be used by producers.

OR

(i) Use CNG or clean fuel in automobiles.

(ii) Do not burn litter. Use it for preparation of manure.

(iii) Use of unleaded petrol

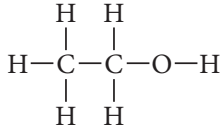
(iv) Afforestation – Excessive plantation should be done.

(v) Remove the harmful gases from smoke, before releasing into atmosphere.

8. (a) Ethanol is C_2H_5OH. So, it is having three different elements that are carbon, oxygen and hydrogen.

(b) (i) Number of valence electrons in carbon = 4
Number of valence electrons in oxygen = 6
Number of valence electrons in hydrogen = 1
So, in ethanol, C_2H_5OH *i.e.*, C_2H_6O, total number of valence electrons = $2 \times 4 + 6 \times 1 + 6 = 20$

(ii) Eight single covalent bonds are present in ethanol.



9. (a) **Valency :** On moving from left to right in a period, the number of valence electrons increase from 1 to 8 although in the first period, it increases from 1 to 2.

Valency = Number of valence electrons (valence electrons are < 4)

Valency = 8 – number of valence electrons (valence electrons are ≥ 4)

Valency remains same in a group.

(b) **Atomic size :** On moving from left to right in a period, the atomic radius decreases due to increase in nuclear charge which tends to pull the electrons closer to the nucleus and reduces the size of the atom.

On moving down the group, the atomic radii of elements increase gradually because new shells are being added.

(c) **Electropositive character :** Tendency of the elements to lose electrons increases down the group. The reason being that at each succeeding element down a group, the number of shells increases. So, the distance of the valence shell from the nucleus increases due to which the effective nuclear charge decreases on the last shell of electrons. So, it becomes easier for the atom to lose electrons.

Tendency of the elements to lose electrons decreases in a period from left to right. The reason being that as the electron enters the same shell at each successive element so, the effective nuclear charge on the valence shell electrons increases.

OR

(a) Proton number = 20 = number of electrons
Electronic configuration = 2, 8, 8, 2

(b) Element *Y* is in group 2 and period 4 because it has 2 electrons in outermost shell and four occupied shells.

(c) It is easier for an atom of element *Y* to lose the two valence electrons to achieve an electronic configuration similar to argon (2, 8, 8). Hence, an atom of element *Y* will form a positive ion with charge equal to its group number, *i.e.* 2. The formula of the ion is Y^{2+}.

10. In regeneration, an organism is cut or broken up into many pieces and these pieces then grow into separate individuals. In nature, most of the organisms would not normally depend on being cut up to be able to reproduce. On the other hand, they would like to survive themselves as well as reproduce new individuals.

11. Sexual mode of reproduction involving fusion of male and female gametes ensures variation in the offsprings. Both male and female gametes are formed as a result of meiosis which is a reductional division in which the chromosome number becomes haploid. Meiosis is often accompanied by crossing over of chromosomes that is responsible for variation in chromosomes. Fusion of gametes results in the formation of zygotes which show a variation from their parents and among themselves. Such variation leads to the survival of the species.

OR

(a) Heredity is the transmission of characters/traits from parents to the offsprings. While genetics is defined as a branch of science which deals with the study of heredity and variation.

(b) Mendel introduced the concept of gene as a basic unit of heredity and called them factors.

12. (a) Scrotum remains outside the body to provide ideal temperature for the formation of sperms. The sperms develop at a temperature which is 2 – 2.5°C lower than the normal body temperature.

(b) The petals of flowers are coloured to attract pollinators for cross pollination.

(c) The plants which are propagated only by vegetative methods either have lost the ability to produce viable seeds or do not produce seeds at all.

13. (a) This food web has five interconnected food chains which are as follows:

1. Plant → Grasshopper → Hawk
2. Plant → Grasshopper → Frog → Hawk

3. Plant → Deer → Hawk
4. Plant → Mouse → Hawk
5. Plant → Mouse → Snake → Hawk

(b) Characteristics of the interaction in the given food web are :

(1) Unlike food chains, food webs are never straight. Instead, each food web is formed by interlinking of food chains.

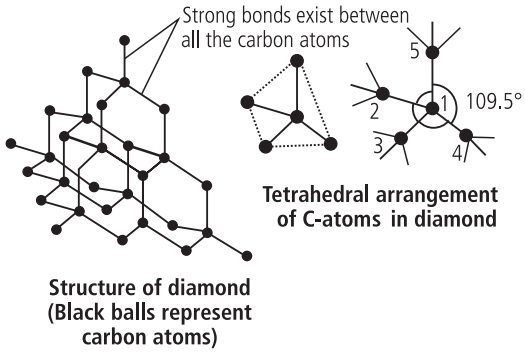
(2) A food web provides alternative pathways of food availability.

14. (a) Diamond has covalent bonds only.

(b) In graphite, each carbon atom is linked to three other carbon atoms by single covalent bonds. The fourth electron on each carbon atom is free and results in conductance of electricity.

(c) In diamond, the outermost shell electrons of carbon are shared with four other carbon atoms to form a very strong chemical bonds resulting in extremely rigid tetrahedral crystal. It is this tightly-bonded arrangement that makes diamond one of the hardest substances.

OR



Structure of diamond (Black balls represent carbon atoms)

15. (a) The cross between black mouse (BB) and a brown mouse (bb) and the inbreeding of their hybrid progeny (Bb) is shown below.

Parents : BB (Black mouse) × bb (Brown mouse)

Gametes : Ⓑ , ⓑ

F_1 generation : Bb (Black mouse)

F_2 generation :

♀ / ♂	B	b
B	BB Black	Bb Black
b	Bb Black	bb Brown

Phenotypic ratio : 3(Black) : 1(Brown)

Genotypic ratio : 1(BB) : 2(Bb) : 1(bb)

(b) Phenotypic ratio is 3 black : 1 brown *i.e.*, 75% of the progeny would have black coat.

(c)

P : Bb × bb

Gametes : B, b, b

F_1 : Bb (Black), bb (brown)

Phenotypic ratio : 1 : 1

OR

P : Bb × BB

Gametes : B, b, B

F_1 : BB (Black), Bb (Black)

100% of the progeny would be black. Back cross is a cross which is made between a hybrid and one of its parents.