Sample Question Paper - 10
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 the number of C - H bonds in ethane C_2H_6 molecule? **[2]**

   ii. Why diamond is not a good conductor of electricity?

2. Elements have been arranged in the following sequence on the basis of their increasing atomic masses. F, Na, Mg, Al, Si, P, S, Cl, Ar, K **[2]**

   i. Pick two sets of elements which have similar properties.

   ii. The given sequence represents which law of classification of elements?

3. What changes are observed in the uterus subsequent to implantation of young embryo? **[2]**
4. Reproduction is essentially a phenomenon that is not for survival of an individual but for continuation of a species. Justify. **[2]**
5. In Mendel's experiment of inheritance in which he took two contrasting characters, i.e. round green and wrinkled yellow seeds, **[2]**

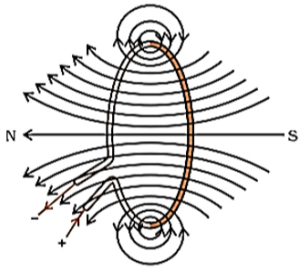
   i. What was the phenotype of offsprings in F_1 - generation?

   ii. What was the ratio of offsprings in F_2 - generation?

   OR

   Name two homologous structures in vertebrates. Why are they so called? How do such organs help in understanding an evolutionary relationship?

6. Magnetic field lines of the field produced by a current-carrying circular loop are shown in the figure. **[2]**



By analyzing the concept of magnetic field and magnetic field lines answer the following questions:

i. How is the direction of the magnetic field at a point determined?

ii. What is the direction of the magnetic field at the centre of a current-carrying circular loop?

7. How can you help in reducing the problem of waste disposal, give any two methods? **[2]**

Section B

8. (a) Lithium, sodium and potassium are all metals that react with water to liberate hydrogen gas. Is there any similarity in the atoms of these elements? **[3]**

(b) Helium is an un-reactive gas and neon is a gas of extremely low reactivity. What, if anything, do their atoms have in common?

9. i. How do covalent compounds normally exist? **[3]**

ii. Why is hydrogen diatomic in nature?

OR

i. Explain the nature of the covalent bond using the bond formation in CH_3Cl.

ii. What is a homologous series? Which two of the following organic compounds belong to the same homologous?

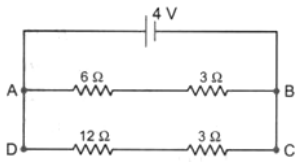
$CH_3, C_2H_6, C_2H_6O, C_2H_6O_2, CH_4O$

10. In a monohybrid cross, pink coloured flowers are dominant over white coloured flowers. If parent plants belong to pure breeding dominant trait and pure breeding recessive trait, what will be the phenotype or morphological feature of F_1-generation? If F_1 plants are self-fertilised, what would be the phenotypic ratio or how many dominant and recessive traits will be produced in the progeny? Explain with an illustration. **[3]**

11. i. A lamp consumes 50 W and is lighted 2 h daily in month of April. How many units of electric energy is consumed? **[3]**

ii. An electric iron of resistance 20 Ω takes a current of 5A. Calculate the heat developed in 30s.

12. For the circuit shown in the given diagram: **[3]**



What is the value of

i. current through 6Ω resistor?

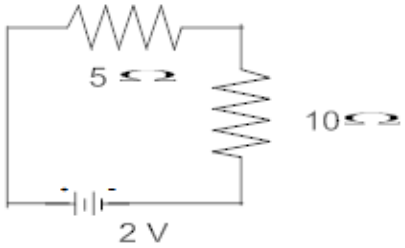
ii. potential difference across 12Ω resistor?

OR

Calculate:

i. the effective resistance of the circuit and the current in the circuit

ii. Potential difference across 10 Ω resistor of a circuit shown in the figure.



13. A modern insecticide has been introduced with certain new properties like accumulation in the bodies of predators, broken down by soil bacteria, easily washed into lakes and rivers and taken up by plant roots. Among all these properties which one will help in reducing or keeping the level of environment pollution to lowest. **[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]**

Mendel crossed tall and dwarf pea plants to study the inheritance of one gene. He collected the seeds produced as a result of this cross and grew them to generate plants of the first hybrid generation which is called the first filial progeny or F_1 Mendel then self-pollinated the tall F_1 plants and he obtained F_2 generation.

i. In garden pea, round shape of seeds is dominant over wrinkled shape. A pea plant heterozygous for round shape of seed is selfed and 1600 seeds produced during the cross are subsequently germinated. How many seedlings would have non-parental phenotype?

ii. If A' represents the dominant gene and 'a represents its recessive allele, which of the following would be the most likely result in the first generation offspring when Aa is crossed with aa?

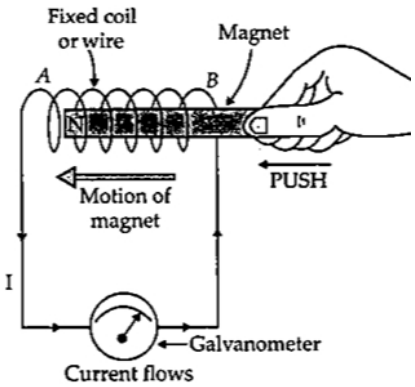
iii. What result Mendel would have got, if he self pollinated a homozygous tall F_2 plant?

OR

In plant, tall phenotype is dominant over dwarf phenotype, and the alleles are designated as T and t, respectively. Upon crossing one tall and one dwarf plant, total 250 plants were obtained, out of which 124 displayed tall phenotype and rest were dwarf. Then, What would be the genotype of the parent plants?

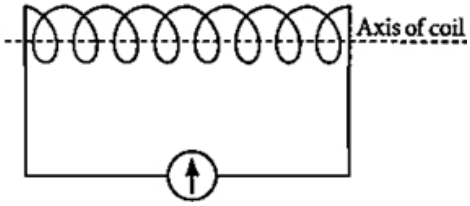
15. **Read the Case study followed by 3 questions Part (i) and (ii) are compulsory. However, an internal choice has been provided in part (iii):** **[4]**

A current carrying wire produces magnetic field around it. The phenomena in which an electromotive force and current (if the conductor is in the form of a closed circuit) is induced by changing magnetic field (or by passing magnetic field lines) through it is called electromagnetic induction. The emf so developed is called induced emf and current made to flow is called induced current.

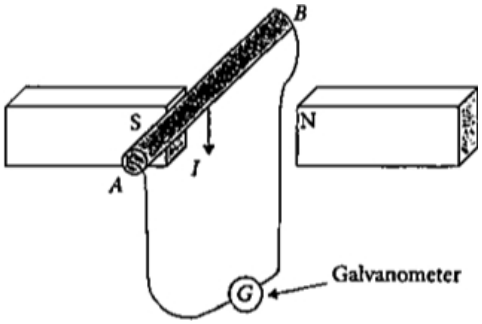


The cause of induced emf carried out by Faraday and Henry. It can be concluded that the induced current flows in a conductor as long as the magnetic lines of force change within the conductor. In case of relative motion i.e., motion of coil w.r.t to magnet or vice versa, the direction of the current flowing in the conductor is determined by the direction of the relative motion of the conductor with respect to the magnetic field. The induced emf or current is directly proportional to the rate of change in magnetic field.

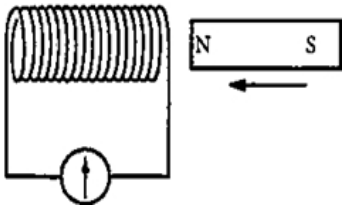
i. A student connects a coil of wire with a sensitive galvanometer as shown in the figure. Where will he observe the deflection in the galvanometer of bar magnet?



ii. A conducting rod AB moves across two magnets as shown in the figure and the needle in the galvanometer deflects momentarily. What is the name of this physical phenomenon?



iii. A bar magnet is pushed steadily into a long solenoid connected to a sensitive meter.



What would affect the magnitude of the deflection of the meter?

OR

An induced emf is produced when a magnet is plunged into a coil. on which factor/factors does the magnitude of induced emf depend?

Solution

SCIENCE - 086

Class 10 - Science

Section A

1. i. The number of C-H bonds in ethane (C_2H_6) molecule is 6. Carbon is tetravalent. Each carbon atom forms 3 single bonds with 3 hydrogen atoms.
   ii. Diamond is not a good conductor of electricity because it has no free electrons in its structure (like graphite) to conduct electric current.
2. i. Na, Mg, Al, and K are metals. F and Cl are Halogens. These make two sets of elements have similar properties.
   ii. Given set represent Mendeleev's law of periodicity.
3. The uterine lining is thickened every month to support the growing embryo. Followed by fertilization, placenta is developed which serve to provide nutrition and oxygen to developing embryo from the mother's blood**.** It is a disc embedded in the uterine wall and contains villi on the embryo's side of the tissue while blood spaces surrounding the villi are present on mother's side. Waste products of developing embryo are removed by transferring them into the mother's blood through the placenta.
4. For survival, an individual needs energy which it obtains from life processes such as nutrition and respiration. Reproduction does not provide energy for survival. Instead, reproduction ensures transfer of genetic material from one generation to the next which helps in continuation of species. Hence, it is an important phenomenon for maintaining continuity of species.
5. i. All offsprings were round yellow in F_1 - generation
   ii. Round yellow - 9
   Round green - 3
   Wrinkled yellow - 3
   Wrinkled green - 1
   Therefore, the ratio of offsprings in F_2-generation is $9:3:3:1$.

   OR

   Two homologous structures in vertebrates are:
   (i) limbs of birds and reptiles
   (ii) limbs of reptiles and amphibians.
   These are called so because the organs have similar structure to perform different functions in various vertebrates.
   The homologous characteristics indicate common ancestory.
6. i. The direction of the magnetic field at a point can be found by placing a small magnetic compass at that point. The north end of the needle of a compass indicates the direction of magnetic field at a point where it is placed.
   ii. The direction of magnetic field at the centre of a current-carrying circular loop is perpendicular to the plane of the loop.
7. i. Recycling of wastes.
   ii. Reduction at source.
   iii. Better management.
   iv. Vermicomposting.
   v. Use of eco-friendly products such as disposable paper cups in place of plastic cups.

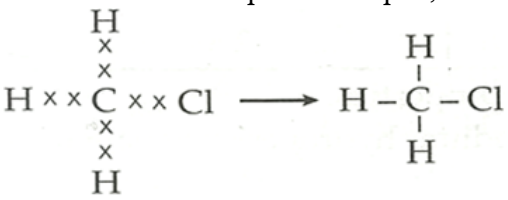
Section B

8. (a) Lithium, sodium and potassium have same number of electrons in the outermost shell.
   (b) Helium and argon have completed outermost shell, 2 electrons in case of helium and 8 electrons in case of argon.
   They have a completely filled octet
9. i. Covalent bonded compounds are usually gases and liquids with low boiling and melting points

ii. Electronic configuration of hydrogen is 1s and to attain the stability i.e., to acquire the electronic configuration of nearest noble gas helium (1s) hydrogen atoms share their single electron with each other Therefore, hydrogen exist in diatomic and not monoatomic hydrogen.

OR

i. Covalent bonding in CH3Cl: Covalent bonds between carbon and hydrogen are formed by sharing of electrons between the two atoms. Carbon has a valency of 4 and requires 4 electrons to complete its octet. In CH3Cl, a carbon atom shares an electron each with three hydrogen atoms and one electron with a chorine atom. A chorine atom requires one electron to complete its octet and a hydrogen atom requires one electron to complete its duplet, and thus become stable.



ii. Homologous series is a series of organic compounds which have same functional group and similar chemical properties. Each member of this series differs by - CH_2 - in its molecular formula and 14 u in its molecular mass.
$C_2H_6O\,(C_2H_5OH)$ and $CH_4O\,(CH_3OH)$ belong to same homologous series.

10. Let the dominant trait be represented by PP.
Let the recessive trait be represented by pp.
Parents PP $\times$ pp
F_1-generation (p_p) (p_p) (p_p) (p_p) i.e. all pink colour flowers, but hybrid. i.e. none are pure homozygous all the progeny has heterozygous combination, but since, pink is dominant over white, all are pink.
F_2-generation when self-fertilised (p_p) $\times$ (p_p)
F_2-generation gives (PP) (Pp) (Pp) (pp)
Ratio 3 pink colour flowers : 1 white colour flower.

11. i. Energy consumed = $\frac{Watt \times hour}{1000} = \frac{50 \times (2\times30)}{1000} = \frac{3000}{1000}$ = 3 unit or 3 kWh
ii. R = 20 Ω; I = 5A; t = 30 s
H = $I^2Rt = (5)^2$ (20) (30)
H = 15,000 J

12. Let the current through the circuit be I which is divided into I_1 and I_2 in the arms AB and CD respectively, then we have
I = I_1 + I_2
In the arm AB, the total resistance is
R_1= 6Ω + 3Ω = 9Ω
and the total resistance in the arm CD is
R_2 = 12Ω + 3Ω = 15Ω

i. Then current in the 6Q resistor i.e.,
$I_1 = \frac{V}{R_1}$
$= \frac{4}{9}$
= 0.44 A

ii. Now the current through CD is
$I_2 = \frac{V}{R_2}$
$= \frac{4}{15}$
= 0.27 A
The potential difference across 12Ω, resistor is
$V_1 = I_2 \times 12\Omega$
$V_1 = 0.27 \times 12$
= 3.23 V

OR

i. $R = R_1 + R_2$

$= 5 + 10 = 15\ \Omega$

$I = \frac{V}{R} = \frac{2}{15}$.

$= 0.133$ A

ii. Potential difference across 10 Ω

$V = IR$

$= \frac{2}{15} \times 10$

$= 1.33$ V

13. Insecticides are non-biodegradable chemicals added to crop fields to kill and stop the growth of insects harmful to crops. Modern insecticides are being developed keeping in mind, the harm they cause to the environment and its components thus they create biodegradable insecticides which can be decomposed into harmless substances, which further degrade and does not accumalate in the environment and causing no pollution. Non-biodegradable insecticides does not degrade but build up in the the body of the organisms and pass on to organisms that feed on it and thus they keep on accumulating along the food chain in increasing amounts, resulting in significant amounts in the tissues of consumers at the highest trophic level this is also known as biological magnification.

The property of newly developed insecticides includes that it can easily get decomposed into simpler components by soil bacteria, i.e. biodegradable, which will help in the reduction of environmental pollution.

Section C

14. i. 400

: Since this pea plant is heterozygous for round shape, its genotype would be Rr.

Parents : Rr × Rr

↓ (selfing)

Progeny : RR Rr Rr rr

Phenotypically, the ratio will be 3 : 1, i.e., only rr seedlings will show wrinkled seed phenotype, rest will show round seed shape.

1200 → Round shape (RR, Rr) 400 → Wrinkled (rr)

ii. Dominant and recessive phenotypes will be 50% each.

A represents the dominant gene and 'a' represents its recessive allele. The most likely result in the first generation offspring when Aa is crossed with aa is :

Parents: Aa × aa

Gametes: (A) (a) (a) (a)

F_1 : Aa Aa aa aa

Hence, A a: aa

1 : 1

iii. Self pollination of homozygous tall F_2 plant (TT) will give rise to all individuals of genotype TT.

OR

Tt × tt

15. i. The deflection in galvanometer can be seen if bar magnet moved towards or away from coil parallel to the axis of the coil.

ii. If the needle of the galvanometer deflects it means there is change in magnetic field and current is induced.

iii. By Faraday's law of electromagnetic induction, the e.m.f. induced in a conductor is proportional to the rate of change of magnetic lines of force linking the circuit. Hence, by pushing in the magnet faster, the rate of change of magnetic lines will increase. This results in a larger induced e.m.f. and hence, larger deflection of the meter.

OR

The number of turns of the coil, The speed with which the magnet is moved, and the strength of the magnet.