Sample Question Paper - 13
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. a. Name the elements present in the third period and classify them into metals and non-metals. **[2]**

   b. On which side of the table do you find the metals?

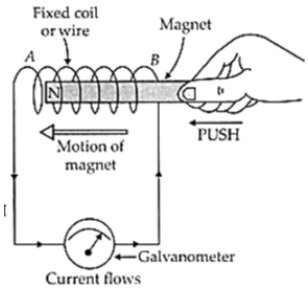
   c. On which side of the table do you find the non-metals?

3. Draw a labelled diagram of the longitudinal section of a flower. **[2]**
4. Explain the term regeneration as used in relation to reproduction. **[2]**
5. If a trait A exists in 10% of population of an asexually reproducing species and a trait B exists in 60% of the same population, which trait is likely to have arisen earlier and why? **[2]**

   OR

   In evolutionary terms can we say that which among bacteria, spider, fish and chimpanzee has a 'better' body design? Why or why not?

6. A current-carrying wire produces a 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. **[2]**



   i. What is the condition of electromagnetic induction?

ii. An induced emf is produced when a magnet is plunged into a coil. The magnitude of induced emf does not depend?

7. Give reason: "Life on earth depends on the sun." **[2]**

Section B

8. An element A reacts with oxygen to form A_2O.. **[3]**

i. State the number of electrons in the outermost orbit of A.

ii. To which group of periodic table does A belong?

iii. State whether A is a metal or non-metal.

9. i. Where do compounds of carbon find applications? **[3]**

ii. Draw the electron dot structures of CO_2 and state the type of bonding.

OR

i. What is a homologous series? State any two characteristics of homologous series?

ii. Why carbon and its compounds are used as fuels in most cases?

10. Two plants, A with white flowers and B with red flowers were crossed. The F_1 progeny shows all red flowers and F_2 has three red and one white. Categorise the trait as dominant and recessive. **[3]**

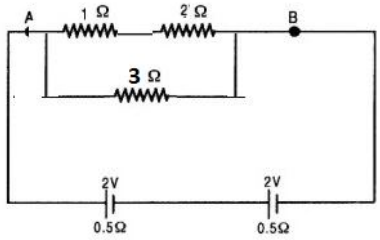
11. a. Two electric lamps rated 100 W,220 V and 60 W,220 V are connected in parallel to electric mains supply. Calculate the current drawn from the mains if the supply voltage is 220 V? **[3]**

b. A lamp consumes 50 W and is lighted 2 h daily in month of April. How many units of electric energy is consumed ?

12. Given in fig. is the circuit diagram in which three resistors of 1Ω, 2Ω and 3Ω are connected to cell of e.m.f. 2V and internal resistance 0.5 Ω. **[3]**

i. Calculate the total resistance of the circuit.

ii. What is the reading of ammeter and What will be ammeter reading if an exactly similar cell is connected in series with the given cell ?

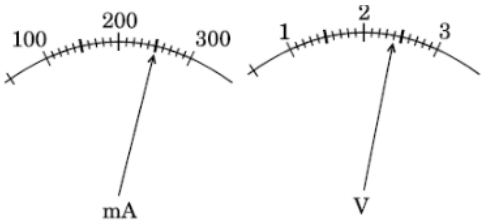


OR

The current flowing through a resistor connected in a circuit and the potential difference developed across its ends are as shown in the diagram by milliammeter and voltmeter readings respectively:

a. What are the least counts of these meters?

b. What is the resistance of the resistor?

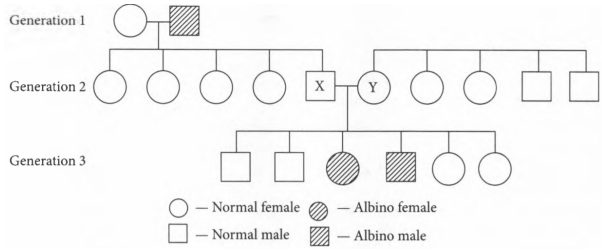


13. A lake has been polluted by sewage. On comparison with the sample of unpolluted water, the water in the lake is found to have increased contents of some components. Identify these components. **[3]**

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]**

Refer to the schematic representation of albinism that is an inherited condition caused by recessive allele (a). 'A' is the dominant allele for the normal condition. The inheritance of certain genetic traits for two or more generations is represented in a pedigree or family tree. Study the given pedigree chart and answer the following questions.



i. What could be the genotypes of X and Y?

ii. What could be the genotype of generation - 1 male and female?

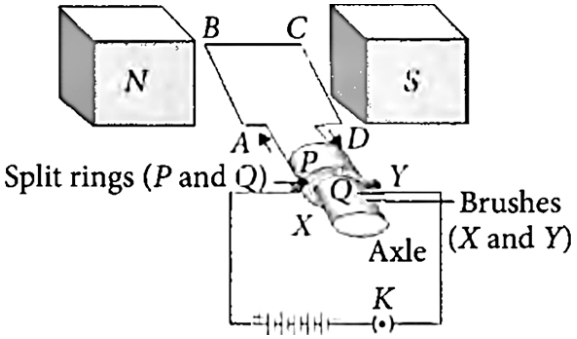
iii. If X married an albino female, then what is the probability that their children would be albino?

OR

If Y married a normal homozygous male, then what is the probability that their children would be albino?

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 electric motor is a rotating device that converts electrical energy into mechanical energy. The electric motor is used as an important component in electric fans, refrigerators, mixers, washing machines, computers, MP3 players, etc.



An electric motor consists of a rectangular coil ABCD of insulated copper wire. The coil is placed between the two poles of a magnetic field such that the arm AB and CD are perpendicular to the direction of the magnetic field. The ends of the coil are connected to the two halves P and Q of a split ring. The inner sides of these halves are insulated and attached to an axle. The external conducting edges of P and Q touch two conducting stationary brushes X and Y, respectively, as shown in the figure.

Commercial motors use an electromagnet in place of a permanent magnet, a large number of

turns of conducting wire in the current carrying coil and a soft iron core on which the coil is wound.

i. Which factor has no effect on the size of the turning effect on the coil of an electric motor?
ii. When current is switched ON, an electric fan converts which energy?
iii. In an electric motor, what is the name of the device that makes contact with the rotating rings and through them to supply current to the coil?

OR

In an electric motor, the direction of current in the coil changes once in how many rotation/rotations?

Solution

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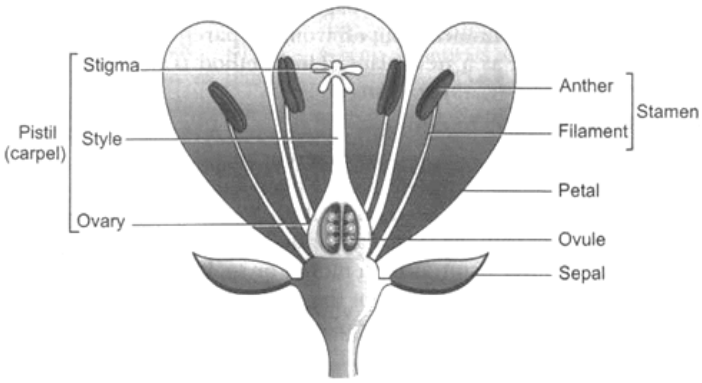
Class 10 - Science

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. a. The elements are
   Na, Mg, Al, Si, P, S, Cl, Ar
   Na , Mg , Al are metals , Si is a metalloid P , S , Cl and Ar are non metals
   b. The metals are placed mostly on the left side of the table.
   c. The non-metals are placed on the right side of the table.
3. 

4. Regeneration is the ability of a living organism to regrow the part of the body that gets broken off or cut. Regeneration is not the same as reproduction, since the organism would not depend on being cut to reproduce. For example, if a hydra breaks horizontally into two parts, then the upper part having the mouth and tentacles regenerates to form the lower part. While the lower part of the original hydra without mouth and tentacles regenerates to form the mouth and tentacles. Thus, two complete organisms are formed from the two cut parts.
5. In asexually reproducing organism trait B have originated earlier. The variations in a population are only due to inaccuracies of DNA copying.

   OR

   It depends on our perception of 'better' design. If complexity of body design is the criterion, then chimpanzee is obviously better than bacteria. But if ability of survival in almost all kinds of habitat is a criterion then bacteria are far ahead than any other group of organisms.
6. i. There must be a relative motion between the coil of wire and a magnet.
   ii. Resistivity of coil will determine the resistance of the coil and induced current through it, as induced current = $\frac{\text{emf}}{\text{resistance}}$
7. Sun is the ultimate source of energy on earth. Producer organisms i.e.plants & some autotrophic microbes can convert solar energy into chemical energy (food), which is transferred to different organisms at various trophic levels. Energy stored in fossil fuel is also transferred solar energy because they are made up of decomposed plants and animals. Hence, solar energy is utilized and transformed in different form which is utilized by us.

Section B

8. i. A reacts with oxygen to form A_2O. That means two electrons are given to oxygen atom by two atoms of A. So each A atom has one electron in its outermost shell.
   ii. A belongs to the first group of the periodic Table because its valency is 1 as it has 1 electron in its outermost shell.
   iii. A is metal since, metal can give up electron and behave as electropositive element.
9. i. The carbon compounds are being increasingly used as a source of energy, as medicines, colours, textiles, plastics, food preservatives etc. Wood contains carbon in the form of cellulose. Plastic contains carbon in

long chains called polymers. Steel contains carbon sandwiched between Iron molecules. Graphite is pure carbon. Diamonds are pure carbon (in a different crystalline structure than graphite).

ii. :O:: C : : O: [CO_2]

The carbon and oxygen atoms are linked by two covalent bonds.

OR

i. A **homologous series** is a series of similarly constituted compounds in which the different members have the same functional group and same chemical properties and in which any two successive members differ in their molecular formula by -CH_2 group. The various organic compounds that form part of the **homologous series** are called **homologues.**

E.g. All **alkanes** have similar structures with single covalent bonds and show similar chemical properties. Thus, all alkanes form a homologous series. The successive members CH_4 (methane), C_2H_6 (ethane), C_3H_8 (propane), etc of alkanes differ from each other by -CH_2 group.

Two characteristics of homologous series are as follows**:**

a. All the compounds of a homologous series have the same functional group. E.g. All alkanes have single covalent bonds between carbon atoms in their structure.

b. All the compounds of a homologous series have the same chemical properties. E.g. All alkanes undergo substitution reactions with halogen vapours in the presence of light.

$$CH_3 - CH_3 + Cl_2 \xrightarrow{sunlight} CH_3 - CH_2Cl + HCl$$

ii. Carbon present in carbon coumpounds burns in oxygen or air to form carbon dioxide (CO_2) gas. This reaction is highly exothermic, that is why different forms of coal are used as fuels.

E.g. When propane (C_3H_8) is burnt in air, a large quantity of heat is produced.

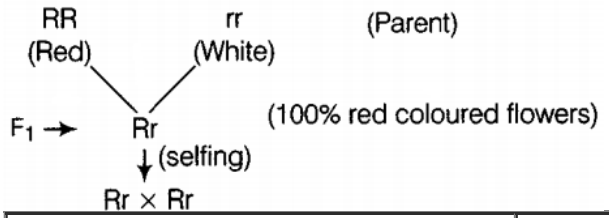
$$C_3H_8 + 5O_2 \rightarrow 3CO_2 \uparrow + 4H_2O + Heat$$

10. When two plants, A with white flowers and B with red flowers were crossed,

In F_1 generation all the plants have red coloured flowers and in F_2 generation the ratio of red : white is 3 : 1.

The dominant trait is red colour in flowers.

The recessive trait is white colour in flowers.



Gametes	**R**	**r**
R	RR(red)	Rr(red)
r	Rr(red)	rr(red)

11. (a) We know that

P = $\frac{V^2}{R}$

Therefore, R = $\frac{V^2}{P}$

Resistance of 1st lamp,

$R_1 = \frac{V^2}{P} = \frac{220 \times 220}{100}$

$= 484\Omega$

Resistance of 2nd lamp,

$R_2 = \frac{220 \times 220}{60}$

$= \frac{2420}{3}\Omega$

Since, two lamps are connected in parallel, so its equivalent resistance is given by

$\frac{1}{R} = \frac{1}{R_1 +} \frac{1}{R_2} = \frac{1}{484} + \frac{3}{2420} = \frac{8}{2420}$

R = $\frac{2420}{8}\Omega$

By Ohm's Law,current drawn from the mains:

I = $\frac{V}{R} = \frac{220 \times 8}{2420}$

= 0.73 A

∴ The current drawn from the mains is 0.73 A

(b) Energy consumed = $\frac{Watt \times hour}{1000} = \frac{50 \times (2 \times 30)}{1000} = \frac{3000}{1000} = 3\ unit\ or\ 3\ kWh$

12. ResisOKtance, 1Ω and 2Ω are in series and combined resistance i.e. 1 + 2 = 3Ω in parallel with 3Ω.
Hence total resistance of the combination is $\frac{1}{R} = \frac{1}{3} + \frac{1}{3} = \frac{2}{3}\ or\ R = \frac{3}{2} = 1.5\Omega$

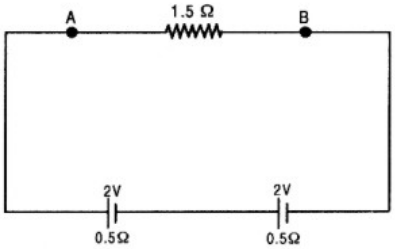
i. Total resistance of the circuit = R + r = 1.5 + 0.5 = 2Ω

ii. Total current through ammeter = $\frac{E}{R + r} = \frac{2}{2} = 1A$

iii. In second case total e.m.f.= 2 + 2 = 4V

Total resistance = 1.5 + 0.5 + 0.5 = 2.5Ω

Current through circuit in second case = $\frac{4}{2.5} = \frac{40}{25} = \frac{8}{5} = 1.6\ A$



OR

a. least count of Ammeter = $\frac{100}{10}$ =10 mA

least count of Voltmeter = $\frac{1}{10}$ = 0.1 V

b. Voltage, V = 2 + 0.1 × 4 = 2.4V and Current, I = 200 + 10 × 5 = 250 mA = 0.25 A

Thus, the resistance of the resistor, R = $\frac{V}{I}$ = $\frac{2.4}{0.25}$ = 9.6 ohm

13. Sewage usually contains organic substances such as house hold waste, animal waste etc. The decomposition of these substances by decomposers increases nitrogenous compounds in water and leads to water pollution.

Section C

14. i. X - Aa, Y - Aa

X and Y parents must have ‘a allele (recessive) that is respective for albinism, the genotype of both X and Y individuals would be Aa and Aa as they are normal and 3rd generation, normal and albino male and female is formed in 3 : 1 ratio

ii. Male - aa, Female - AA

Albinism is caused by the recessive allele. The children of generation-1, male and female all are normal (Aa). So, in generation-1, the genotype of female must be AA as she is normal and genotype of male is aa as he is albino male.

iii. Albinism is caused by the recessive allele and father of X is albino male so, the genotype of X is Aa and genotype of albino female is aa. So, the probability that their children would be albino is 50% or 0.5.

OR

0

15. i. The direction of the current has no effect on the size of the turning effect on the coil.

ii. Electric fan works on the principle of electric motor. It converts electrical energy to mechanical energy.

iii. brushes

OR

half rotation