

**Sample Question Paper - 8**  
**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. Carbon forms four covalent bonds by sharing its four valence electrons with four univalent atoms, e.g. hydrogen. After the formation of four bonds, carbon attains the electronic configuration same as which element? [2]  
ii. What is the correct electron dot structure of a water molecule?
2. The atomic numbers of Mg and Al are 12 and 13 respectively. [2]  
i. Write the electronic configuration of each element.  
ii. Which of these two has large atomic radius?
3. What substances pass [2]  
i. from the maternal to the foetal blood?  
ii. from the foetal to the maternal blood?
4. i. Write one difference between asexual and sexual modes of reproduction. [2]  
ii. Which species is likely to have better chances of survival, the one reproducing asexually or the one reproducing sexually? Justify your answer.
5. A chimpanzee can hold objects by its hand and an elephant by its trunk. Are these two organs analogous or homologous? Give reason in support of your answer. [2]

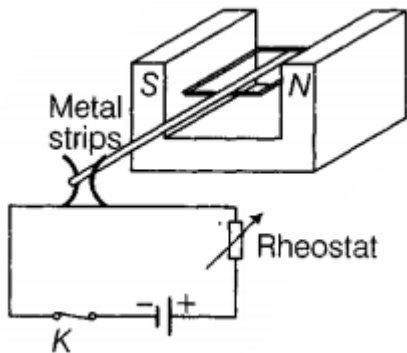
OR

A Mendelian's experiment consist of breeding a pea plant bearing violet flowers with pea plant that bear white flowers. What will be the result in F<sub>1</sub> progeny?

6. The given figure shows a DC motor model used by a student to study electromagnetism. The two ends of the coil are fixed to a pair of curved elastic metal strips. The metal strips are [2]



connected to the power supply with a rheostat.



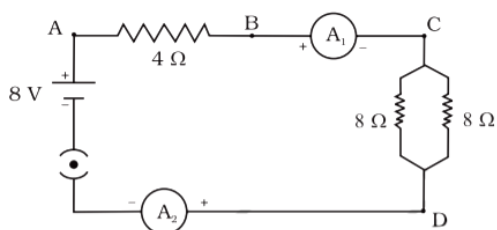
- i. State the direction of rotation of the coil when viewed from the front.
  - ii. The student is still testing on the feasibility of using the metal strips in the model. What is he trying to achieve?
7. Draw a sequence of suitable methods of disposal of waste produced at your home to minimise environmental pollution. [2]

### Section B

8. An element M with electronic configuration (2, 8,2) combines separately with  $(\text{NO}_3)^-$ ,  $(\text{SO}_4)^{2-}$  and  $(\text{PO}_4)^{3-}$  radicals. [3]
- i. Write the formula of the three compounds so formed.
  - ii. To which group and period of the modern periodic table do the elements M belong?
  - iii. Will M form covalent or ionic compounds? Give a reason to justify your answer.
9. i. Where do compounds of carbon find applications? [3]  
 ii. Give three characteristic properties of covalent compounds.

OR

- i. How do covalent compounds normally exist?
  - ii. Why is hydrogen diatomic in nature?
10. In pea plant, round seed is dominant over the wrinkled. If a cross is carried out between these two plants, give answer to the following questions. [3]
- i. Mention the genes for the traits of parents.
  - ii. State the trait of  $F_1$  hybrids.
  - iii. Write the ratio of  $F_2$  progeny obtained from this cross. What is the name of the cross?
11. Calculate the total cost of running the following electrical devices in the month of September, if the rate of 1 unit of electricity is Rs. 6.00. [3]
- i. Electric heater of 1000 W for 5 hours daily.
  - ii. Electric refrigerator of 400 W for 10 hours daily.
12. Find out the following in the electric circuit given in Figure [3]

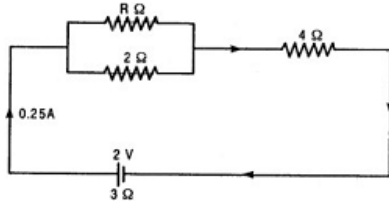


- i. The effective resistance of two  $8\ \Omega$  resistors in the combination
- ii. Current flowing through  $4\ \Omega$  resistor

OR

The following circuit diagram shows three resistors  $2\ \Omega$ ,  $4\ \Omega$ ,  $R\ \Omega$  connected to a battery of e.m.f.  $2\text{ V}$  and internal resistance  $3\ \Omega$ . A main current of  $0.25\text{ A}$  flows through the circuit.

- a. What is the potential difference across  $R\ \Omega$  and  $2\ \Omega$  resistors ?
- b. Calculate the value of  $R$ .



13. The activities of man had adverse effects on all forms of living organisms in the biosphere. Unlimited exploitation of nature by man disturbed the delicate ecological balanced between the living and non-living components of the biosphere. The unfavourable conditions created by man himself threatened the survival not only of himself but also of the entire living organisms on the mother earth. One of your classmates is an active member of 'Eco club' of your school, which is creating enviromental awareness amongst the school students, spreading the same in the sociey and also working hard for preventing environmental degradatation of the surroundings. [3]
- i. Why is it necessary to conserve our environment?
  - ii. State the importance of green and blue dustbins in the safe disposal of the household waste.
  - iii. List two values exhibited by your classmate who is an active member of Eco-club of your school?

### Section C

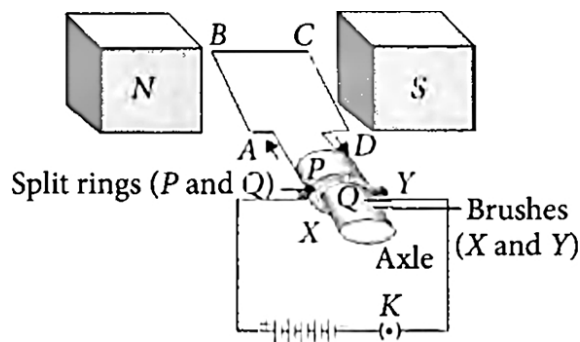
14. **Read the Case study followed by 3 questions Part (i) and (ii) are compulsory. However, an internal choice has been provided in part (iii):** [4]
- Purebred pea plant with smooth seeds (dominated characteristic) were crossed with purebred pea plant with wrinkled seeds (recessive characteristic). The  $F_1$  generation was self-pollinated to give rise to the  $F_2$  generation.
- i. What will be the genotypic ratio of the given  $F_2$  generation?
  - ii. What is the expected observation of the  $F_2$  generation of plants?
  - iii. If a genotype consists of different types of alleles, what is it called?

OR

What is the alternative form of the gene?

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**  
**SCIENCE - 086**  
**Class 10 - Science**

**Section A**

1. i. Electronic configuration of carbon is 2, 4 and after sharing four electrons from four univalent atoms, its electronic configuration becomes 2, 8 which is the same as that of Neon.  
ii.  $\text{H}:\ddot{\text{O}}:$  Has this dot structure shows a complete octet after oxygen shared two electrons with two univalent atoms of hydrogen.
2. The electronic configuration of the two atoms are:  
Mg ( $Z = 12$ ) = 2, 8, 2  
Al ( $Z = 13$ ) = 2, 8, 3  
Both these elements are present in the third period. Al comes after Mg. The atomic radius decreases when moving from left to right along a period. This is due to an increase in nuclear charge which tends to pull the electrons closer to the nucleus and reduces the size of the atom. Therefore, the atomic radius of Mg is more.
3. i. Oxygen, nutrients (food and water) pass from maternal to foetal blood.  
ii. Carbon dioxide and other waste substances like nitrogenous waste(urea) pass from foetal to maternal blood.
4. Sexual reproduction takes place with the help of fusion of male and female gametes, thus 2 haploid gametes restore the diploid nucleus and thus form zygote, which have content from both the parent and hence producing a new recombination Whereas, in asexual reproduction the offspring develops from a single parent, the genetic material of the offspring is exact copy of the single parent.  
Better chances of survival are seen in sexually reproducing organisms. This is because variation occurs in sexual reproduction which improves the vigour and vitality of the individual. This is helpful for the organisms in better adaptability to the environment.
5. Trunk of the elephant and hand of a chimpanzee are Analogous organs because they do same function but have different origin. They both do work of hand for picking various things.

OR

The result in F1 progeny will be violet flowers because it is dominants over the white flowers.

6. i. The direction of rotation of the coil is anti-clockwise when viewed from the front.  
ii. He is trying to achieve the rotation of the coil in one direction. As the current in the coil reverses for every half turn, the coil rotates in one direction.
7. The household waste produced from various activities is called garbage and its proper disposal is done in such a way that it does not cause environmental pollution.  
Methods of waste disposal include:
  - i. Recycling : The processing of certain wastes to form new products is called recycling, e.g. paper, glass etc., are recyclable.
  - ii. Composting : It is the process of collecting biodegradable wastes like leftovers of food items, peels, etc. and burying them in a pit and using it as manure.
  - iii. Incineration : It is burning of a substance at high temperature to reduce it to ashes.
  - iv. Landfills : Dumping of non-biodegradable waste in low-lying areas is called landfill.
  - v. Sewage treatment : In sewage treatment plants, the sewage is processed and decomposed into simpler inorganic chemicals.

**Section B**

8. Given, Element M with electronic configuration,  $\frac{K}{2}, \frac{L}{8}, \frac{M}{2}$

Total number of electrons =  $2 + 8 + 2 = 12$  which means the given element has atomic number 12, i.e.

magnesium (Mg). Formula of compound formed, when element M (Mg) combines separately with  $(\text{NO}_3)^-$ ,

$(\text{SO}_4)^{2-}$  and  $(\text{PO}_4)^{3-}$  radicals are as follows:

$$\text{i. Charge} = +2 - 1$$

Formula of compound =  $\text{Mg}(\text{NO}_3)_2$  (Magnesium nitrate)

$$\text{ii. Charge} = +2 - 2$$

Formula of compound =  $\text{MgSO}_4$  (Magnesium sulphate)

$$\text{iii. Charge} = +2 - 3$$

Formula of compound  $\text{Mg}_3(\text{PO}_3)_2$  (Magnesium phosphate)

M will belong to group 2 as M has 2 valence electrons in its outer most shell and the number of valence electron will decide the group number. The element M belong to period 3 of the periodic table since it has 3 shells. M will form ionic compound with all given radicals. As M is a metal and metal always form ionic compounds.

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. Characteristic properties of covalent compounds.**

- Covalent compounds exist as single molecules which are mostly in gaseous state (hydrogen, oxygen, ammonia). Some of them may be liquid (bromine) and few as solids (iodine, phosphorus)
- Covalent compounds have usually low melting and boiling point. Since no ions are present in the covalent molecules.
- Covalent compounds are poor conductors of electricity because the current is carried by the movement of ions.
- Covalent compounds generally react in molecular form.
- Covalent compounds are not soluble in water. They dissolve in covalent solvent like carbon tetrachloride, benzene etc. (any three)

OR

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.

10. i. RR for homozygous pure round. And rr for homozygous pure wrinkle pea plant.  
 ii. Rr (hybrid) - heterozygous. All are round since round is dominant over wrinkled.  
 iii. 3:1 (phenotypic ratio), 1:2:1 (genotypic ratio) The name of this cross is monohybrid cross.

$$11. P_1 = \frac{1000W}{1000} = 1kW$$

$$t_1 = 5 \text{ h}$$

$$P_2 = \frac{400W}{1000} = 0.4 \text{ kW}$$

$$t_2 = 10 \text{ h}$$

No. of days n = 30

Energy consumed by heater:

$$E_1 = P_1 \times t_1 \times n = 1 \text{ kW} \times 5 \text{ h} \times 30 = 150 \text{ kWh}$$

Energy consumed by refrigerator:

$$E_2 = P_2 \times t_2 \times n = 0.4 \text{ kW} \times 10 \text{ h} \times 30 = 120 \text{ kWh}$$

$$\text{Total energy} = (150 + 120) \text{ kWh} = 270 \text{ kWh}$$

We know that 1kWh = 1unit, so

$$270 \text{ kWh} = 270 \text{ units}$$

Cost of 1 unit is Rs. 6.00

$$\text{Total cost} = 270 \times 6 = \text{Rs. } 1620$$

12. Given :-

Resistor,  $R_1 = 4 \Omega$

Resistor,  $R_2 = 8 \Omega$

Resistor,  $R_3 = 8 \Omega$

Potential Difference,  $V = 8$  volts.

- i. Since two  $8\Omega$  resistances are in parallel, their effective resistance ( $R_p$ ) is given by  $\frac{1}{R'} = \frac{1}{8} + \frac{1}{8} + \frac{1}{4}$  or  $R' = 4\Omega$
- ii. The total resistance in the circuit,  $R = 4\Omega + R_p = 4\Omega + 4\Omega = 8\Omega$   
Current through the electric circuit,  $I = \frac{V}{R} = \frac{8}{4} = 2A$   
Since  $4\Omega$  resistor and  $R_p$  are in series, the current through  $4\Omega$  resistors =  $1A$ .

OR

Current in the circuit =  $0.25 A$

Current through  $4\Omega$  wire =  $0.25 A$

a. P.D. across  $R\Omega = 2 - (1 + 0.75) = 0.25 V$

Where  $R'$  is the combined resistance of  $2$  and  $R \Omega$  in parallel and is given by

$$\frac{1}{R'} = \frac{1}{R} + \frac{1}{2} = \frac{2+R}{2R} \text{ or } R' = \frac{2R}{2+R}$$

$$\text{P.D. across } R' = 0.25 \quad R' = 0.25 \times \frac{2R}{2+R} = \frac{0.5R}{2+R}$$

P.D. across  $R' = 0.25$  volt from (c)

$$\therefore 0.25 = \frac{0.5R}{2+R} \text{ or } 1 = \frac{2R}{R+2}$$

$$R + 2 = 2R \text{ Or } r = 2\Omega$$

13.
  - i. It is necessary to conserve our environment for the sustenance of the present life and also for the future generations. We exist because of support and supply from nature our sole existence is not possible.
  - ii. Green dustbin (for biodegradable waste) and blue dustbin (for non-biodegradable waste) should be used in household for the proper segregation of waste. If both type of waste are segregated, they can be treated accordingly.
  - iii. My classmate reflects eco-friendly nature, concern towards the environment and knowledge of environmental issues.

### Section C

14.
  - i. In given case, genotypic ratio of  $F_2$  progeny will be  $1:2:1$  where, one is homozygous dominant, two are heterozygous dominant and one is homozygous recessive
  - ii.  $\frac{1}{4}$  of them have wrinkled seeds and  $\frac{3}{4}$  of them have smooth seeds.
  - iii. Factors representing the alternate or same form of a character are called alleles. In heterozygous individuals or hybrids, a character is represented by two contrasting alleles. Out of the two contrasting alleles, only one is able to express its effect in the individual. It is called dominant allele. The other allele which does not show its effect in the heterozygous individual is called recessive allele, e.g., in case of hybrid tall pea plants ( $Tt$ ). 'T' is dominant allele whereas 't' is recessive allele.

OR

allele

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

