Sample Question Paper - 24
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. (a) Name the pair of elements in the Mendeleev's periodic table whose positions were not in increasing order of their atomic masses.

(b) If *R* is the symbol of an element in the third period and third group of Mendeleev's periodic table then what is the formula of its oxide?

2. Why do you think the noble gases are placed in a separate group?

OR

Two elements *X* and *Y* belong to group 1 and 2 respectively and are in the same period of the periodic table. How do the following properties of *X* and *Y* vary?

(i) Size of their atoms. (ii) Their metallic character.

3. Draw a diagram showing spore formation in *Rhizopus*.

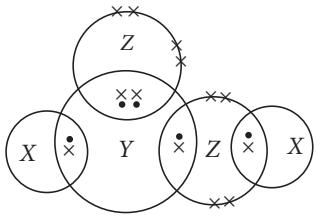
4. Tallness of pea plant is a dominant trait, while dwarfness is the recessive trait. When a pure-line tall is crossed with pure-line dwarf, what fraction of tall plants in F_2 generation shall be heterozygous? Give reasons.

5. We often observe domestic waste decomposing in the bylanes of residential colonies. Suggest ways to make the residents realise that the improper disposal of their waste is harmful to the environment.

OR

"A given species may occupy more than one trophic level in the same ecosystem at the same time". Explain with an example.

6. The given diagram shows the arrangement of valence electrons in organic compound *Q*, with the molecular formula X_2YZ_2.



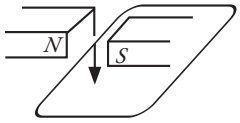
What could be compound *Q*?

OR

(a) How many bonds are formed between two atoms of oxygen?

(b) How many single and double bonds are present in benzene molecule?

7. The wire in the figure below is being moved downwards through the magnetic field, so as to produce induced current.



What would be the effect of

(a) moving the wire at a higher speed?

(b) moving the wire upwards rather than downwards?

(c) using a stronger magnet?

(d) holding the wire at rest in the magnetic field?

SECTION - B

8. Write the full form of DNA. Name the part of the cell where it is located. Explain its role in the process of reproduction of the cell.

OR

Reproduction is linked to stability of population of a species. Justify the statement.

9. Trace the path of sperm during ejaculation and mention the glands and their functions associated with the male reproductive system.

10. (a) Name the factors on which the amount of heat produced depend, when current passed through the circuit.

(b) A resistance of 40 Ω and one of 60 Ω are arranged in series across 220 volt supply. Find the heat in joules produced by this combination of resistances in half a minute.

OR

A refrigerator having a power rating of 350 W operates for 10 hour a day. Calculate the cost (in ₹) of electrical energy to operate it for a month of 30 days. The rate of electrical energy is ₹ 3.40 per kWh.

11. (a) With the help of a suitable circuit diagram prove that the reciprocal of the equivalent resistance of a group of resistances joined in parallel is equal to the sum of the reciprocals of the individual resistances.

(b) In an electric circuit two resistors of 12 Ω each are joined in parallel to a 6 V battery. Find the current drawn from the battery.

12. (a) Write the conclusions Mendel arrived at about dominance of traits on the basis of monohybrid crosses that he carried out in pea plants.

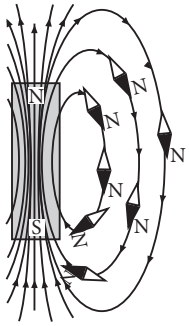
(b) Explain why a recessive allele is unable to express itself in a heterozygous state.

13. Farmers are advised to add biofertilizer in the soil instead of chemical fertilizers to combat the pollution. What are the harmful by-products of fertiliser industries? How do they affect 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. A magnetic field is described by drawing the magnetic field lines. When a small north magnetic pole is placed in the magnetic field created by a magnet, it will experience a force. And if the north pole is free, it will move under the influence of magnetic field. The path traced by a north magnetic pole free to move under the influence of a magnetic field is called a magnetic field line. Since the direction of magnetic field line is the direction of force on a north pole, so the magnetic field lines always begin from the N-pole of a magnet and end on the S-pole of the magnet. Inside the magnet, however the direction of magnetic field lines is from the S-pole of the magnet to the N-pole of the magnet. Thus, the magnetic field lines are closed curves. When a small compass is moved along a magnetic field line, the compass needle always sets itself along the line tangential to it. So, a line drawn from the south pole of the compass needle to its north pole indicates the direction of the magnetic field at that point.



(a) Does magnetic field lines intersect each other? Explain.

(b) Can a magnetic monopole (isolated pole) exist?

(c) Draw the figure showing magnetic field lines due to a bar magnet and explain it.

OR

Can you think of magnetic field configuration with three poles?

15. A hydrocarbon (*P*) has the molecular formula $C_{10}H_{22}$. A hydrocarbon (*Q*) has two carbon atoms less than (*P*) and belong to the same homologous series. A hydrocarbon (*R*) has two carbon atoms more than (*P*) and belong to the same homologous series.

(a) What is the molecular formula of (*Q*)?

(b) To which homologous series do the compound (*P*), (*Q*) and (*R*) belong?

(c) What is the trend of physical and chemical properties of compounds (*P*), (*Q*), (*R*)?

OR

Write the molecular formula of preceding and succeeding homologues of hydrocarbon (*R*)?

Solution

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1. (a) Co and Ni (b) R_2O_3

2. Out of all the elements known, noble gases such as helium (He), neon (Ne), argon (Ar), krypton (Kr) and xenon (Xe) are the most inert (unreactive) and are present in extremely low concentrations in our atmosphere. Therefore, they are grouped together in a separate group called zero group in the Mendeleev's periodic table.

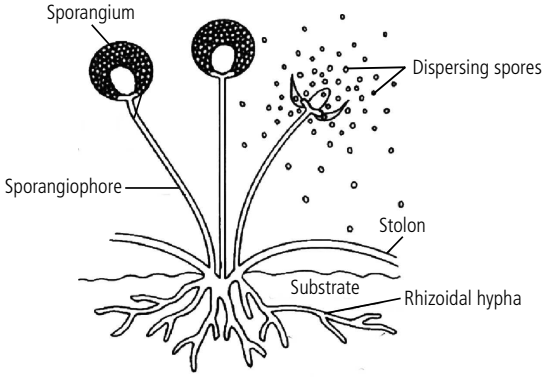
OR

X belongs to group-1 while *Y* belongs to group-2 of the same period hence, valency of *X* will be 1 and valency of *Y* will be 2.

(i) As we move along the period from left to right the size of the atoms decreases. Hence, *X* will be bigger than *Y*.

(ii) Across the period from left to right, the metallic character decreases. Hence, *X* is more metallic than *Y*.

3. Following figure shows the process of spore formation in *Rhizopus*:



4.

Parents	Tall	×	Dwarf
Genotype :	TT		tt
Gametes :	T		t
F_1:	Tt		

Selfing

F_2:

♀ \ ♂	T	t
T	TT Tall	Tt Tall
t	Tt Tall	tt Dwarf

Fraction of heterozygous tall plants in $F_2 = \frac{1}{2}$.

This can be explained by law of segregation which states that the members of the allelic pair that remained together in the parent, segregate during gamete formation and only one factor enters a gamete.

5. Some of the ways to make people realise that the improper disposal of waste is harmful to the environment are :

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

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

(iii) Forming an eco-club in the society for spreading awareness about the ill-effects of improper disposal of waste.

OR

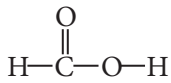
In an ecosystem, one organism may occupy more than one trophic level simultaneously. One must remember that the trophic level represents a functional level, not a species level as such. A given species may occupy more than one trophic level in the same ecosystem at the same time; for example, a sparrow is a primary consumer when it eats seeds, fruits, peas, etc. and a secondary consumer when it eats insects and worms.

6. Element *X* has only one valence electron. So it is a hydrogen atom.

Element *Y* has four valence electrons. So it is a carbon atom.

Element *Z* has six valence electrons. So it is an oxygen atom.

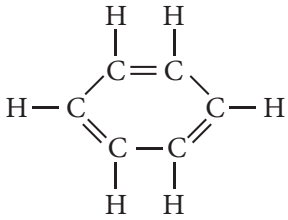
The molecular formula of compound *Q* is H_2CO_2. There is a C = O bond. Hence, *Q* is methanoic acid.



OR

(a) Oxygen has the atomic number 8. Its electronic configuration is 2, 6 and it requires two more electrons to complete its octet. So, each atom of oxygen shares two electrons with another atom of oxygen. The two electrons contributed by each oxygen atom give rise to two shared pairs of electrons, thus it leads to formation of double bond between two oxygen atoms.

(b) Structure of benzene is



∴ Number of single bonds in benzene = 9

Number of double bonds in benzene = 3

7. (a) The induced current increases at a higher speed.

(b) The induced current is reversed.

(c) The induced current increases.
(d) The induced current is zero.

8. The full form of DNA is deoxyribonucleic acid. It is located in the nucleus of a cell in the form of chromosomes. It contains information for the inheritance of characteristics from the parents to the next generation. Copying of DNA is an essential part of the process of reproduction because it makes possible the transmission of parental characteristics to its offspring in the next generation. The replication of DNA ensures that each daughter cell formed at the end of cell division, receives equal amount of DNA. DNA copying is accompanied by creation of additional cellular apparatus and then DNA copies separate, each with its own cellular apparatus. Thus, a cell divides to form two daughter cells.

OR

Reproduction is the only process to ensure the continuity of a species. During reproduction, DNA passes from one generation to the next. Copying of DNA takes place with consistency but with minor variations. This consistency leads to stability of species. Hence, reproduction is linked to stability of a species population. By reproduction, organisms produce large number of new individuals of their own kind out of which several get perished and only some survive. These surviving organisms replace the naturally dying members of the population. Hence, the population as a whole is not affected and remains stable.

9. Sperms formed in testes are passed into the vas deferens (pl. vasa deferentia). The vasa deferentia loops over the urinary bladder where they are joined by ducts from seminal vesicles to form ejaculatory ducts. Seminal vesicles are a pair of sac like structures which stores sperms and produces viscous fluid containing nutrients (fructose). Ejaculatory ducts join urethra and receive secretions of prostate gland and Cowper's gland. Prostate gland is a single large gland that pours its secretion into urethra, through small ducts. It secretes milky fluid which helps in the mobility of sperms. Cowper's glands secrete an alkaline fluid into the urethra that neutralises acids from urine. Urethra is about 20 cm long in males which runs through penis and opens to outside through male genital pore. At the time of sexual excitement, the erectile tissue of penis gets filled with blood causing penis to become erect. It is inserted into the vagina of the female where sperms are ejaculated.

10. (a) Joule's law of heating states that, the amount of heat produced in the circuit, when a current flows through it is, directly proportional to :
(i) square of the current (I) flowing through the conductor, for a given conductor and time.
(ii) resistance (R) of the conductor, for a given current and time,
(iii) time (t) for which current is passed for a given conductor and time.
Therefore, as per Joule's law of heating, we can write that, heat produced, $H = I^2Rt$
(b) Equivalent resistance of the circuit,
$R = 60 + 40 = 100\ \Omega$
Voltage, $V = 220$ V; time, $t = 1/2$ min. $= 30$ s.

$\therefore$ Heat produced, $H = I^2 Rt = \dfrac{V^2}{R}t = \dfrac{(220)^2}{100} \times 30$
$= 14520$ W $= 14.52$ kW

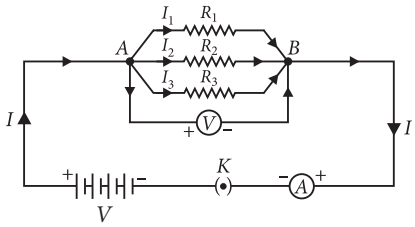
OR

Electric energy, $E = P \times t$

Here, Power, $P = 350$ W $= \dfrac{350}{1000}$ kW $= 0.35$ kW

And Time, $t = 10 \times 30$ hours $= 300$ h
Now, putting these values of P and t in the formula,
$E = P \times t$
We get, $E = 0.35 \times 300$ kWh $= 105$ kWh
Thus, the electrical energy consumed by the refrigerator in a month of 30 days is 105 kilowatt-hours.
Now, cost of 1 kWh of electricity = ₹ 3.40
So, cost of 105 kWh of electricity = ₹ 3.40×105
= ₹ 357

11. (a) Resistors in parallel : When resistors are connected in parallel.



(i) The potential difference across their ends is the same.
(ii) The sum of current through them is the current drawn from the source of energy or cell.

$I = I_1 + I_2 + I_3$ or $\dfrac{V}{R_P} = \dfrac{V}{R_1} + \dfrac{V}{R_2} + \dfrac{V}{R_3}$

(iii) The equivalent resistance is given by,

$\dfrac{1}{R_P} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

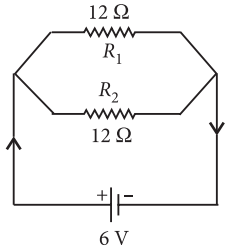
Hence equivalent resistance in parallel combination is equal to the sum of reciprocals of the individual resistances.

(b) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$

$\frac{1}{R} = \frac{1}{12} + \frac{1}{12} = \frac{2}{12}$

$\Rightarrow \quad R = 6\ \Omega$

$\therefore$ Current, $I = \frac{V}{R} = \frac{6}{6} = 1\ \text{A}$



12. (a) Whenever Mendel carried out a cross between plants for a contrasting trait he found that only one trait out of the two appears in the F_1 generation. He concluded that the trait which is expressed in F_1 is dominant while the one which remains hidden is recessive. He also said that characters are controlled by discrete unit called factors which occur in pair.

(b) In a heterozygous state there is one dominant allele and one recessive allele. Dominant allele masks the expression of the recessive allele in the heterozygous condition. Thus, recessive allele can only be expressed in homozygous states in either generation.

13. By-products are the products formed side by side with the production of main substances. By-products from fertiliser industries are :

(i) NO_x - Oxides of nitrogen

(ii) SO_2 - Oxides of sulphur

Effects of these by-products are :

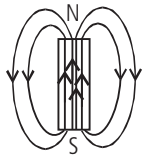
(i) Air pollution – Oxides of nitrogen and sulphur released by fertiliser industries cause air pollution as these gases are undesirable and create various harmful effects.

(ii) Acid rain – Oxides of sulphur and nitrogen *i.e.*, SO_2 and NO_x are responsible for lowering the pH of rain creating acid rain. Acid rain consists of acids like nitric acid and sulphuric acid formed by dissolution of oxides of nitrogen and sulphur in water. Acid deposition is of two types – dry and wet. Acid rain has various harmful effects on our environment such as yellowing of marble, death of planktons, molluscs and fish (if below 5 pH), disturbance of food chains, etc.

14. (a) No two magnetic field lines are found to cross each other. If two field lines crossed each other, it would mean that at the point of intersection, the compass needle would point in two directions at the same time, which is not possible.

(b) No, a North pole and South pole are produced simultaneously. We cannot create an isolated North pole or an isolated South pole.

(c) The magnetic field lines due to a bar magnet are closed continuous curves directed from N to S outside the magnet and directed from S to N inside the magnet.



OR

Magnetic poles always exist in pairs. However one can imagine magnetic field configuration with three poles, when North poles of two magnets are glued together or South poles of two magnets are glued together to provide three field configuration.

15. (a)Molecular formula of (*Q*) is C_8H_{18} as it has two carbon atoms less than (*P*).

(b) Compounds (*P*), (*Q*) and (*R*) are alkanes having general formula C_nH_{2n+2}.

(c) Compound (*P*), (*Q*) and (*R*) belong to same homologous series so they have different physical properties but similar chemical properties. They have same general formula C_nH_{2n+2}. They differ by 2 carbon atoms and 4 hydrogen atoms.

OR

Molecular formula of preceding member of compound (*R*) is $C_{11}H_{24}$ and succeeding member of (*R*) is $C_{13}H_{28}$.