Sample Question Paper - 31
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. Let there be n resistors R_1 .....R_n with R_{max} = max $\{R_1$..... $R_n\}$ and R_{min} = min $\{R_1$ ..... $R_n\}$. Show that when they are connected in parallel, the resultant resistance $R_P < R_{min}$ and when they are connected in series, the resultant resistance $R_S > R_{max}$. Interpret the result physically.

2. An electric iron draws a current of 0.5 A when voltage is 200 V. Calculate the amount of charge flowing through it in one hour.

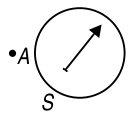
OR

On what factors does the resistance of a conductor depend? Will current flow more easily through a thick wire or a thin wire of the same material when connected to the same source? Why?

3. A 40 watt lamp requires 0.182 A of current at 220 volts, while a 60 watt lamp requires 0.272 A of current at 220 volts. If a 40 watt lamp and a 60 watt lamp are connected in series with a 220 volt line, how many amperes of current will flow through each lamp?

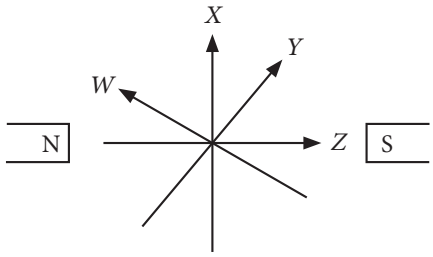
4. What are magnetic field lines? Two magnetic field lines never intersect each other. Justify.

5. A magnetic compass needle is placed in the plane of paper near point A as shown in figure. In which plane should a straight current carrying conductor be placed so that it passes through A and there is no change in the deflection of the compass? Under what condition is the deflection maximum and why?

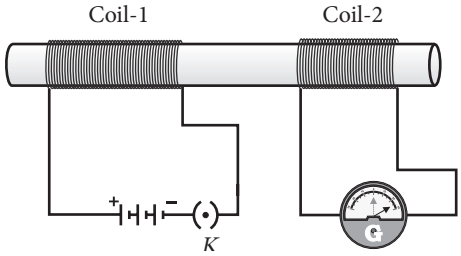


OR

Four current-carrying wires W, X, Y and Z are placed between two magnets as shown below. Which wire will experience the smallest magnetic force?



6. A student has two copper coils having large number of turns on a single non-conducting cylindrical roll. He connects one coil to the battery and a key and another coil to the galvanometer. What will he observe when



(a) key is inserted? (b) key is removed?

7. Differentiate between food chain and food web.

OR

Trophic levels are the feeding position of all organisms in a specific ecosystem. Organisms that derive their energy from the same source belong to the same trophic level. Why are only 4 or 5 trophic levels present in each food chain?

SECTION - B

8. State three limitations of Newlands' law of octaves.

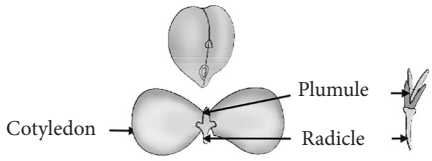
9. Write a short note on different amorphous forms of carbon.

OR

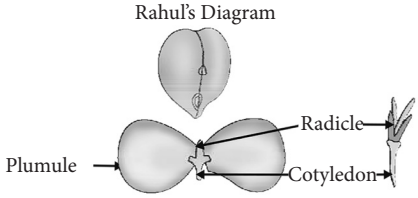
Why is homologous series of carbon compounds so called? Write the chemical formula of two consecutive members of any homologous series and state the part of these compounds that determines their (i) physical and (ii) chemical properties.

10. Pooja and Rahul were performing an experiment on seed germination. They drew the following two figures after a study of the germinated Bengal gram seeds.

Pooja's Diagram



Rahul's Diagram



(a) Which one out of the two diagrams is incorrect?

(b) What do radicle and plumule develop into?

(c) Draw diagrammatic representation of hypogeal germination.

11. (a) Mention the reproductive parts of a flower.

(b) What is the function of human placenta?

12. Differentiate between genotype and phenotype.

OR

In certain plant, yellow fruit colour (Y) is dominant to green fruit colour (y) and round shape (R) is dominant to oval shape (r). The two genes involved are located on different chromosomes. What would be genotypic and phenotypic ratio when plant YyRr is back crossed with the double recessive parent?

13. Write three characteristics features of energy transfer in the biosphere?

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. Generally metals possessing 1, 2 or 3 electrons in their respective valence shells have a strong tendency to lose electrons to form positive ions. Non-metals, on the other hand, having 4 to 8 electrons in their respective outermost shells generally have a tendency to gain electrons to form negative ions. Metallic character is called electropositive character and non-metallic character is called electronegative character. The metallic character increases down a group and non-metallic character increases along a period.

(a) Will you consider the element with atomic number 14 as metal, non-metal or metalloid?

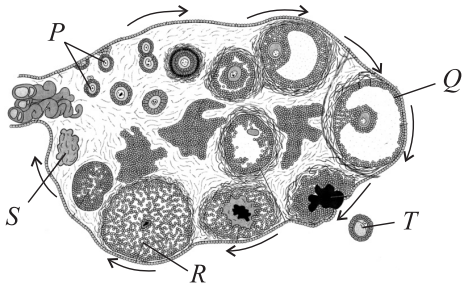
(b) Out of N, P, As, Sb, which of the following is least metallic?

(c) Arrange the elements Li, Na, K and Rb in increasing order of their metallic character.

OR

Consider the elements B, C, N, F and Si. Arrange these elements in decreasing order of their non-metallic character.

15. The figure given below shows monthly changes in the human ovary during the reproductive cycle.



(a) What is term used for release of *T*?

(b) Which hormone is secreted by *R*?

(c) Which hormones are secreted by *P* and *Q* and write their functions.

OR

What will happen to *R* if T is not fertilised?

Solution

SCIENCE - 086

Class 10 - Science

1. When n resistors are connected in parallel, the effective resistance R_P is

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + ... + \frac{1}{R_n}$$

$$\frac{R_{\min}}{R_P} = \frac{R_{\min}}{R_1} + \frac{R_{\min}}{R_2} + ... + \frac{R_{\min}}{R_n}$$

Since $\frac{R_{\min}}{R_1} ... \frac{R_{\min}}{R_n} \leq 1$

$\therefore \quad \frac{R_{\min}}{R_P} > 1$

or $R_{\min} > R_P$

When n resistors are in series, then

$R_S = R_1 + R_2 + ... + R_n$

$\therefore \quad R_S > R_{\max}$

2. Here, $I = 0.5$ A, $t = 1$ hour $= 60 \times 60 = 3600$ s

$\therefore \; Q = I \times t = 0.5 \times 3600 = 1800$ C

Note that the voltage, *i.e.*, 200 V does not enter into calculation of charge flowing through the electric iron as it only maintains a current of 0.5 A through the electric iron.

OR

The resistance (R) of a conductor depends upon :

(i) its length (l), *i.e.*, $R \propto l$.

(ii) its cross-sectional area (A) *i.e.*, $R \propto 1/A$

(iii) nature of material

(iv) temperature.

3. Using the formula, $R = \frac{P}{I^2}$

Resistance of 40 W lamp $= \frac{40 \text{ W}}{(0.182 \text{ A})^2} = 1207.6\ \Omega$

Resistance of 60 W lamp $= \frac{60 \text{ W}}{(0.272 \text{ A})^2} = 811.0\ \Omega$

When the two bulbs are connected in series,

Total resistance of the combination

$= 1207.6\ \Omega + 811.0\ \Omega = 2018.6$ W

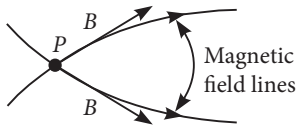
Applied voltage = 220 V

So, current flowing through the circuit $= \frac{V}{R}$

$= \frac{220 \text{ V}}{2018.6\ \Omega} = 0.109$ A

4. Magnetic field lines are curved imaginary lines used to show the magnetic field in a given region.

Necessary parameters are:



The direction of magnetic field (B) at any point is obtained by drawing a tangent to the magnetic field line at that point. In case, two magnetic field lines intersect each other at the point P as shown in figure, magnetic field at P will have two directions, shown by two arrows, one drawn to each magnetic field line at P, which is not possible.

5. For no change in the deflection of the compass, magnetic field produced by the straight current carrying conductor should be perpendicular to the plane of paper, that is current direction must lie in the plane of paper or conductor should be placed in the plane of paper. When the conductor is placed perpendicular to the plane of paper, magnetic field produced by it will be in the plane of paper and therefore there will be maximum deflection in the galvanometer.

OR

For the same current and the same magnetic field, the wire in which current is flowing perpendicularly to the magnetic field will experience the strongest magnetic force and the wire in which current is flowing in parallel to the magnetic field will not feel any magnetic force. Since, magnetic field is almost parallel along Z therefore wire Z will experience smallest magnetic force.

6. (a) When key is inserted, the needle of the galvanometer instantly jumps to one side and quickly returns to zero.

(b) When key is removed, the needle again moves momentarily but in opposite side as compared to case(a).

7. Differences between food chain and food web are:

	Food chain	**Food web**
(i)	It is the single straight pathway in which one organism consumes the other.	It is number of food chains interconnected at various trophic levels.

(ii)	Each organism of higher trophic level receives food from single type of organisms of lower trophic level.	Each organism of higher trophic level receives food from number of alternative organisms of the lower trophic level.
(iii)	It does not add adaptability in organism.	It increases adaptability in organism.
(iv)	Only the members of one trophic level compete for obtaining the same food.	Competition is among members of different species. It is less severe as a number of alternate foods are available.

OR

The quantum of available energy in a food chain successively gets decreased at each trophic level. There is only 10% flow of energy from one trophic level to the next higher level. Second law of thermodynamics says that transformation of energy from one form to the other is inefficient and involves dissipation of unavailable energy. This loss of energy at successive trophic levels restricts the size of food chain in an ecosystem to maximum 4 to 5 steps. Hence, only 4 to 5 trophic levels are present in each food chain.

8. (a) The law was applicable to elements upto calcium. After calcium, every eighth element does not possess the same properties similar to that of the first.
(b) Newlands assumed that only 56 elements existed in nature. But later on several new elements were discovered whose properties did not fit into law of octaves.
(c) In order to fit elements into the table, Newlands adjusted two elements like cobalt and nickel in the same slot and also put some unlike elements under same note.

9. The different amorphous forms of carbon are as follows:
Coke : When coal is subjected to destructive distillation for the manufacture of oil gas, coke is left as residue in the retort. It is a greyish hard solid.
Coke is used as a fuel and largely as a reducing agent in metallurgy.
Charcoal : It is a black, soft and highly porous substance. It exists in following forms : (i) wood charcoal, (ii) animal charcoal and (iii) sugar charcoal. Being highly porous, activated charcoal is used in adsorbing poisonous gases; also used in water filters to remove organic contaminators and in air-conditioning systems to control odour.
Animal charcoal and sugar charcoal are used to remove colouring matter.
Carbon black or lamp black : It is obtained by heating hydrocarbons rich in carbon in limited supply of air.

$$CH_4 + O_2 \xrightarrow{\text{Heat}} C + 2H_2O$$

Carbon black is used as black pigment in black ink and as filler in automobile tyres.

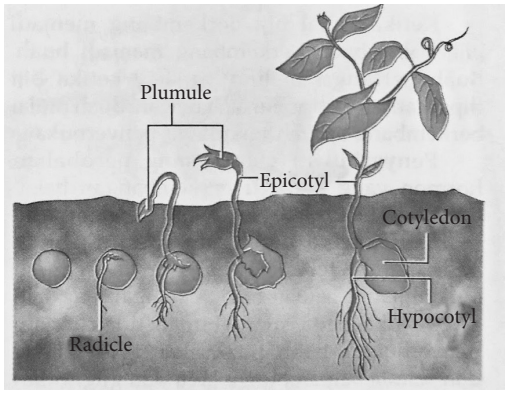
OR

A homologous series is the family of organic compounds having the same functional group, similar chemical properties but the successive (adjacent) members of the series differ by a $-CH_2$ unit or 14 mass units.
Consecutive members of the homologous series of alcohols are :

$$\left.\begin{matrix} CH_3OH \\ C_2H_5OH \end{matrix}\right] \text{They differ by } -CH_2 \text{ unit.}$$

The physical properties are determined by alkyl group/ hydrocarbon part other than the functional group.
The chemical properties are determined by functional group such as —OH group.

10. (a) The figure drawn by Rahul is incorrect.
(b) Radicle develops into root system while plumule develops into shoot system.
(c)



11. (a) Stamens are the male reproductive parts and the carpels are the female reproductive parts of a flower. Each stamen has anther and filament. Anther produces pollen grains which possess male gametes. Each carpel has stigma, style and ovary. The ovules situated inside the ovary possess female gametes.
(b) During pregnancy, exchange of materials between mother's blood and the blood of fetus take place through placenta. The placenta serves as the nutritive, respiratory and excretory organ of the fetus.

12. Difference between genotype and phenotype are as follows :

	Genotype	Phenotype
(i)	It is the genetic composition of an individual.	It is the external manifestation of gene product brought to expression.
(ii)	It remains same throughout the life of an individual.	It may change with time *e.g.*, infant, adolescent, young and old.
(iii)	Individuals with different genotypes may have similar phenotype, *e.g.* tallness for TT and Tt.	Individuals with different phenotypes usually have different genotypes.

OR

When YyRr (heterozygous plant) is crossed with double recessive parent (yyrr), then genotypic and phenotypic ratio will be 1 : 1 : 1 : 1.

Parents : YyRr × yyrr

↓

Progenies :

♀ / ♂	yr
YR	YyRr Yellow round
Yr	Yyrr Yellow oval
yR	yyRr Green round
yr	yyrr Green oval

Phenotypic ratio = 1 yellow round : 1 yellow oval : 1 green round : 1 green and oval. This represents a test cross.

13. The following are the characteristics of energy transfer in the biosphere: (any three)

(i) Energy is supplied by the sun and it is not created in the biosphere. Energy is only converted from one form to another in the biosphere.

(ii) The flow of energy is unidirectional.

(iii) There is loss of energy as we go from one trophic level to the next in an ecosystem.

(iv) At each transfer, generally 80-90% of energy is lost as heat in accordance with second law of thermodynamics.

14. (a) The element with atomic number 14 is Si (silicon) which is a metalloid.

(b) The least metallic is N(nitrogen) out of N, P, As and Sb.

(c) Metallic character increases down the group and decreases across a period. The increasing order of metallic character of the given elements is Li < Na < K < Rb.

OR

Non-metallic character decreases down the group and increases across a period. The decreasing order of non-metallic character of given elements is F > N > C > B > Si.

15. (a) Ovulation is the release of ovum (T) from the ovary.

(b) R(Corpus luteum) secretes the hormone progesterone.

(c) *P* (Primary follicle) and *Q* (Graafian follicle) secrete estrogen which stimulates the proliferation of endometrial lining of the uterine wall.

OR

In the absence of fertilisation, (*i.e.*, fusion of sperm and ovum (T)) corpus luteum (R) degenerates which causes disintegration of the endometrium leading to menstruation, marking a new cycle.