Science Delhi (Set 2)

General Instructions:

Read the following instructions very carefully and strictly follow them:

*(i) Question paper comprises **three** sections - **A, B** and **C.***
*There are **30** questions in the question paper. All questions are compulsory.*

*(ii) **Section A** - question no. 1 to 14 - all questions or part thereof are of one mark each. These questions comprises multiple choice questions (MCQ), very short answer (VSA), and Assertion-Reason type questions. Answer to these questions should be given in **one word or one sentence.***

*(iii) **Section B -** question no. 15 to 24 are short answer type questions, carrying 3 marks each. Answer to these questions should not exceed 50 to 60 words.*

*(iv) **Section C -** question no. 25 to 30 are long answer type questions, carrying 5 marks each. Answer to these questions should not exceed 80 to 90 words.*

(v) Answer should be brief and to the point. Also the above mentioned word limit be adhered to as far as possible.

(vi) There is no overall choice in the question paper. However, an internal choice has been provided in some questions in each Section. Only one of the choices in such questions have to be attempted.

(vii) In addition to this, separate instructions are given with each section and question, wherever necessary.

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Question 1

Name the functional group present in propanone.

Solution:

The functional group present in propanone is a ketone.

Question 2

The change in magnetic field lines in a coil is the cause of induced electric current in it. Name the underlying phenomenon.

Solution:

The phenomenon is Electromagnetic Induction

Question 3

The growing size of the human population is a cause of concern for all people. The rate of birth and death in a given population will determine its size. Reproduction is the process by which organisms increase their population. The process of sexual maturation for reproduction is gradual and takes place while general body growth is still going on. Some degree of sexual maturation does not necessarily mean that the mind or body is ready for sexual acts or for having and bringing up children. Various contraceptive devices are being used by human beings to control the size of population.

(a) List two common signs of sexual maturation in boys and girls.
(b) What is the result of reckless female foeticide?
(c) Which contraceptive method changes the hormonal balance of the body?
(d) Write two factors that determine the size of a population.

Solution:

a) Two common signs for sexual maturation in boys and girls are as follows:

1. Broadening of shoulder and chest in boys and development of mammary gland or breast in girls.
2. Appearance of hairs on various body parts like pubic area, armpits and face.

b) The number of females will become very low in comparison to the males. Hence, there will be a huge imbalance between male female ratio in the population.

c) Chemical method of contraception e.g. Oral pills interferes with the hormonal balance of the body.

d) Birth rate and death rate are factors that determine the size of a population.

Question 4

Human body is made up of five important components, of which water is the main component. Food as well as potable water are essential for every human being. The food is obtained from plants through agriculture. Pesticides are being used extensively for a high yield in the fields. These pesticides are absorbed by the plants from the soil along with water and minerals and from the water bodies these pesticides are taken up by the aquatic animals and plants. As these chemicals are not biodegradables, they get accumulated progressively at each trophic level. The maximum concentration of these chemicals gets accumulated in our bodies and greatly affects the health of our mind and body.

(a) Why is the maximum concentration of pesticides found in human beings?
(b) Give one method which could be applied to reduce our intake of pesticides through food to some extent.
(c) Various steps in a food chain represent :

(a) Food web
(b) Trophic level
(c) Ecosystem
(d) Biomagnification

(d) With regard to various food chains operating in an ecosystem, man is a:

(a) Consumer
(b) Producer
(c) Producer and consumer
(d) Producer and decomposer

Solution:

a) Maximum concentration of pesticides is found in human beings because humans are at the top of the food chain and due to biomagnification, the concentration of Dichlorodiphenyltrichloroethane (DDT) increases as one goes up the trophic levels.

b) Instead of synthetic pesticides, organic farming should be done and more biopesticides should be used.

c) The various steps in a food chain represent the trophic level.

Hence, the correct answer is option B.

d) Man is a consumer with respect to various food chains operating in an ecosystem.

Hence, the correct answer is option A.

Question 5

The compound obtained on reaction of iron with steam is/are :
(a) Fe_2O_3
(b) Fe_3O_4
(c) FeO
(d) Fe_2O_3 and Fe_3O_4

OR

An element 'X' reacts with O_2 to give a compound with a high melting point. This compound is also soluble in water. The element 'X' is likely to be:
(a) iron

(b) calcium
(c) carbon
(d) silicon

Solution:

Iron on reaction with steam gives iron(II, III) oxide.
$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$
Hence, the correct answer is option B.

OR

The compound having a high melting point which indicates that the compound is ionic. Calcium and oxygen react with each other and form CaO which has a high melting point and is water-soluble.

Hence, the correct answer is option (b).

Question 6

The laws of reflection hold true for:
(a) plane mirrors only
(b) concave mirrors only
(c) convex mirrors only
(d) all reflecting surfaces

OR

When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is :
(a) real
(b) inverted
(c) virtual and inverted
(d) virtual and erect

Solution:

The laws of reflection holds true for all reflecting surfaces.

Thus, the correct answer is option (d).

OR

When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is virtual and erect.

Thus, the correct answer is option (d).

Question 7

At the time of short circuit, the electric current in the circuit :
(a) vary continuously
(b) does not change
(c) reduces substantially
(d) increases heavily

OR

Two bulbs of 100 W and 40 W are connected in series. The current through the 100 W bulb is 1 A. The current through the 40 W bulb will be:
(a) 0.4 A
(b) 0.6 A
(c) 0.8 A
(d) 1A

Solution:

At the time of short circuit, the electric current in the circuit increases heavily

Hence, the correct answer is option D.

OR

The current through the 40 W bulb will be 1 A.

Hence, the correct answer is option D.

Question 8

The chemical formula for plaster of Paris is :

(a) $CaSO_4.\ 2H_2O$

(b) $CaSO_4.\ H_2O$

(c) $CaSO_4 \cdot \frac{1}{2}H_2O$

(d) $2CaSO_4.\ H_2O$

Solution:

The chemical formula of plaster of Paris is $CaSO_4.\ \frac{1}{2}H_2O$.

Hence, the correct answer is option C.

Question 9

In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution:
(A) exchange of atoms takes place
(B) exchange of ions takes place
(C) a precipitate is produced
(D) an insoluble salt is produced

The correct option is:
(a) (B) and (D)
(b) (A) and (C)
(c) only (B)
(d) (B), (C) and (D)

Solution:

$$\underset{\text{Sodium sulphate}}{Na_2SO_4(aq)} + \underset{\text{Barium Chloride}}{BaCl_2(aq)} \rightarrow \underset{\text{Barium Sulphate}}{BaSO_4(s)} + \underset{\text{Sodium Chloride}}{2NaCl\ (aq)}$$

The white precipitate of $BaSO_4$ is formed by the reaction of SO_4^{2-} and Ba^{2+}.

Hence, the correct answer is option (d).

Question 10

Baking soda is a mixture of:
(a) Sodium carbonate and acetic acid
(b) Sodium carbonate and tartaric acid
(c) Sodium hydrogen carbonate and tartaric acid
(d) Sodium hydrogen carbonate and acetic acid

Solution:

Baking soda is a mixture of sodium hydrogen carbonate and tartaric acid.

Hence, the correct answer is option C.

Disclaimer: The question has an error. It should be baking powder instead of baking soda.

Question 11

In an ecosystem, 10% of energy available for transfer from one trophic level to the next is in the form of:
(a) heat energy
(b) chemical energy
(c) mechanical energy
(d) light energy

Solution:

The 10% of energy available for transfer from one trophic level to the next in an ecosystem is in the form of chemical energy. The producers capture the energy of sunlight and convert it into chemical energy of food (carbohydrate), which is passed to other trophic levels.

Hence, the correct answer is option B.

Question 12

Soil fertility is determined by its ability to :
(a) Decay organic matter
(b) Hold organic matter
(c) Hold water
(d) Support life

Solution:

Soil fertility is the ability of the soil to supply essential plant nutrients and water in adequate amounts for plant growth and reproduction, thereby supporting life.

Hence, the correct answer is option D.

Question 13

Two statements are given - one labelled Assertion (A) and the other labelled Reason (R).
Assertion (A) : In a homologous series of alcohols, the formula for the second member is C_2H_5OH and the third member is C_3H_7OH.
Reason (R) : The difference between the molecular masses of the two consecutive members of a homologous series is 144.

Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
(a) Both A and R are true and R is the correct explanation of the Assertion.
(b) Both A and R are true but R is not the correct explanation of the Assertion.
(c) A is true but R is false.
(d) A is false but R is true.

Solution:

In a homologous series of alcohols, the formula for the second member is C_2H_5OH and the third member is C_3H_7OH. The difference between the molecular masses of the two consecutive members of a homologous series is 14. The assertion is true and Reason is false.

Hence, the correct answer is option C.

Question 14

Two statements are given - one labelled Assertion (A) and the other labelled Reason (R).

Assertion (A) : In the process of nuclear fission, the amount of nuclear energy generated by the fission of an atom of uranium is so tremendous that it produces 10 million times the energy produced by the combustion of an atom of carbon from coal.

Reason (R) : The nucleus of a heavy atom such as uranium, when bombarded with low energy neutrons, splits apart into lighter nuclei. The mass difference between the original nucleus and the product nuclei gets converted to tremendous energy.

Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
(a) Both A and R are true and R is the correct explanation of the Assertion.
(b) Both A and R true but R is not the correct explanation of the Assertion.
(c) A is true but R is false.
(d) A is false but R is true.

Solution:

When uranium-235 atoms are bombarded with slow-moving neutrons, the heavy uranium nucleus breaks up to produce two medium-weight atoms, barium-139 and krypton-94, with the emission of 3 neutrons.

The neutrons produced in a fission process cause further fission of the heavy nuclei leading to a self-sustaining chain reaction. When all the neutrons produced during the fission of uranium are allowed to cause further fission, then a large amount of energy is produced in a very short time that it cannot be controlled and this leads to an explosion called atom bomb. The energy thus generated by the fission of Uranium atom is 10 Million times the energy produced by the combustion of an atom of Carbon from Coal.

So, both Assertion and Reason is correct and Reason is the correct explanation of Assertion

Hence, the correct answer is option A.

Question 15

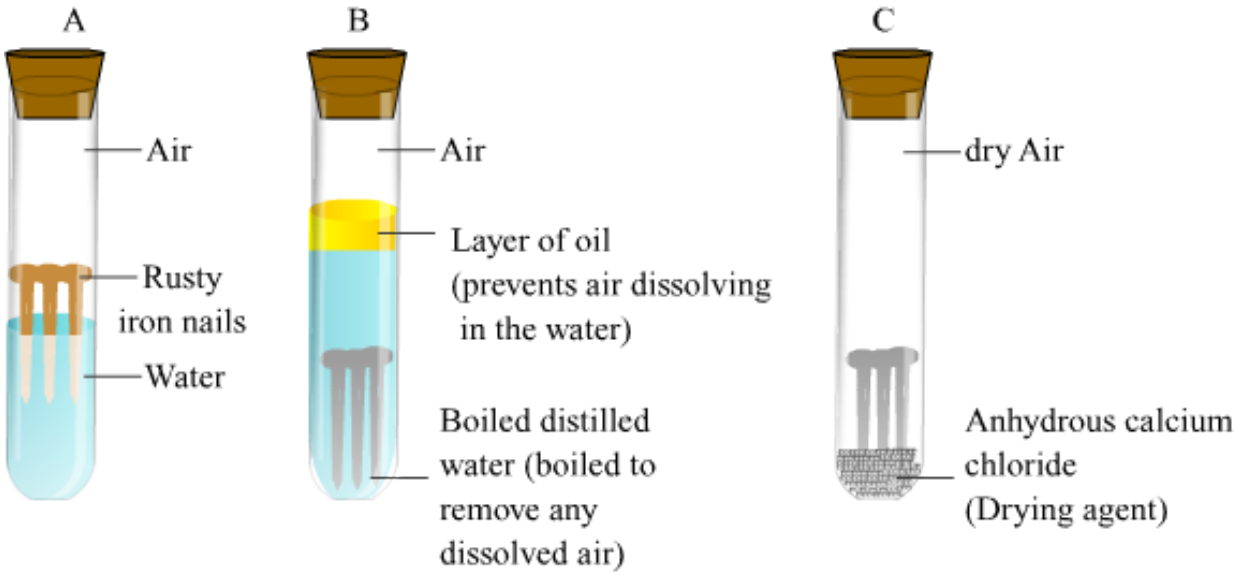
What is "rusting"? Describe with a labelled diagram an activity to investigate the conditions under which iron rusts.

Solution:

When iron is exposed to moist air for a long time, it acquires a coating of a brown flaky substance called rust. This process is known as rusting.

To investigate the conditions under which iron rust, the following activity can be performed:

- Take three test tubes and place clean iron in each of them.
- Label these test tubes A, B and C. Pour some water in test tube A and cork it.
- Pour boiled distilled water in test tube B, add about 1 ml of oil and cork it.
- Put some anhydrous calcium chloride in test tube C and cork it.



On leaving these test tubes for a few days, it will be observed that iron nails rust in test tube A but they do not rust in test tubes B and C.
In the test tube A, the nails are exposed to both air and water.

In the test tube B, the nails are exposed to only water because the oil will float on water and prevent the air from dissolving in the water.
In the test tube C, the nails are exposed to dry air because anhydrous calcium chloride will absorb the moisture from the air.

Hence, air and water both are the essential conditions for rusting.

Question 16

What are homologous structures? Give an example. Is it necessary that homologous structures always have a common ancestor. Justify your answer.

Solution:

Homologous organs: These are organs that are similar in origin, but perform different functions. For example, the forelimbs of humans and the wings of birds perform different functions, but their skeletal structures are similar.

Yes, homology indicates common ancestry. Homologous organs follow the same basic plan of organisation during their development but in the adult condition, these organs are modified to perform different functions as an adaptation to different environments.

Question 17

Why is Tyndall effect shown by colloidal particles? State four instances of observing the Tyndall effect.

OR

Differentiate between a glass slab and a glass prism. What happens when a narrow beam of (i) a monochromatic light, and (ii) white light passes through (a) glass slab and (b) glass prism?

Solution:

Tyndall Effect : It is the effect under which a ray of light scatters in all direction as soon as it encounters a colloidal or suspension particle. It is shown by colloidal particles because the colloidal particles size are roughly equal to the wavelength of the light.

Four instances of observing tyndall effect:

1. It can be observed in fog.
2. It can be observed when light passes through the canopy in forest.
3. It is the reason of blue colour of sky.
4. It can be observed when light passes through the milk.

OR

Glass slab: It is rectangular in shape and made up of glass. In glass slab, the direction of incident ray and emergent ray of light are parallel to each other.

Glass Prism: It has two triangular sides, two inclined rectangular sides and one rectangular base. In glass prism, the direction of incident ray and emergent ray of light are not parallel to each other.

When a narrow beam of monochromatic light passes through:

- Glass slab: It is deviated from the actual path but the direction of incident ray and emergent ray of light are parallel to each other.
- Glass prism: It is deviated from the actual path but the direction of incident ray and emergent ray of light are not parallel to each other.

When a narrow beam of white light passes through:

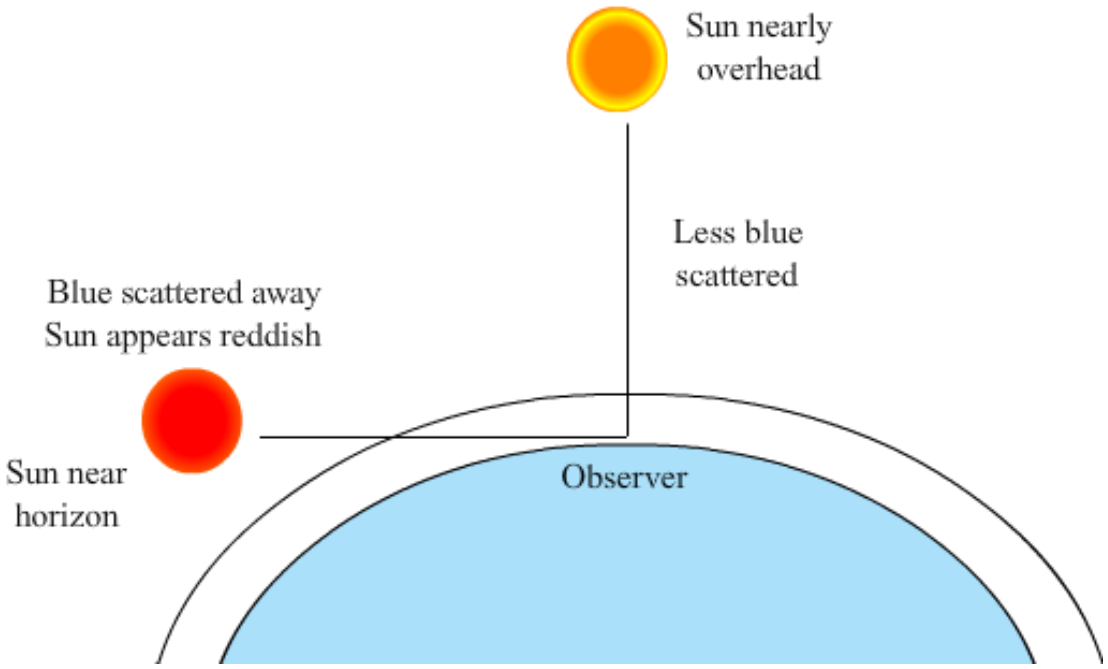
- Glass slab: The splitting of white light into its constituent colour does not occur. And the direction of incident ray and emergent ray of light are parallel to each other.
- Glass prism: The splitting of white light into its constituent seven colours occurs. And the direction of incident ray and emergent ray of light are not parallel to each other.

Question 18

Draw a labelled diagram to show (i) reddish appearance of the sun at the sunrise or the sunset and (ii) white appearance of the sun at noon when it is overhead.

Solution:

i) The reddish appearance of the sun at sunrise or sunset is due to the scattering of light by the molecules of air and other fine particles in the atmosphere that have the size smaller than the wavelength of visible light from the sun near the horizon. Light travels larger distances at the horizon in the earth's atmosphere before reaching our eyes and most of the blue light and shorter wavelengths are scattered away by the particles. So, only red light, being of higher wavelength reaches us which gives the reddish appearance of the sun at sunrise or sunset.



ii) At noon, the sun appears white, not red, as only a little of the blue and violet colors are scattered because light from the Sun overhead would travel a relatively shorter distance.

Question 19

(a) List in tabular form two differences between binary fission and multiple fission.

(b) What happens when a mature *Spirogyra* filament attains considerable length.

Solution:

(a) The key differences between binary fission and multiple fission are as follows:

Binary fission	**Multiple fission**

1. In binary fission, a single organism divides to give rise to two organisms.	1. In multiple fission, a single organism divides to give rise to multiple organisms.
2. In this type of division, cyst formation does not take place.	2. Cyst formation occurs in this particular division.

(b) *Spirogyra* reproduces asexually through fragmentation. In this reproductive process, after attaining considerable length (maturation), the *Spirogyra* breaks down into fragments and consequently, each fragment gives rise to a new *Spirogyra*.

Question 20

List the important products of the Chlor-alkali process. Write one important use of each.

OR

How is washing soda prepared from sodium carbonate? Give its chemical equation. State the type of this salt. Name the type of hardness of water which can be removed by it?

Solution:

There are three products that are produced in the Chlor-alkali process, which are Sodium Hydroxide(NaOH), chlorine gas (Cl_2) and hydrogen gas(H_2).
Uses of sodium hydroxide:
1. It is used in the manufacturing of paper.
2. It is used for making soaps and detergents.

Uses of chlorine gas:
1. It is used in the production of bleaching powder.
2. It is used to make plastics(PVC), pesticides chlorofluorocarbon(CFCs), chloroform, carbon tetrachloride, Paints.

Uses of hydrogen gas:
1. It is used as a fuel for rockets.
2. It is used in the hydrogenation of oils to obtain vegetable ghee.

OR

Washing soda is prepared from sodium carbonate by recrystallisation .

$$\underset{\text{Sodium carbonate}}{Na_2CO_3} + 10H_2O \rightarrow \underset{\text{Washing soda}}{Na_2CO_3.10H_2O}$$

Washing soda is a basic salt. It is used for removing permanent hardness of water.

Question 21

3 mL of ethanol is taken in a test tube and warmed gently in a water bath. A 5% solution of alkaline potassium permanganate is added first drop by drop to this solution, then in excess.

(i) How is 5% solution of $KMnO_4$ prepared?

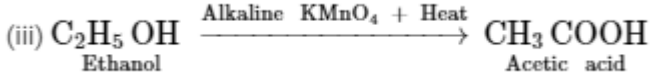
(ii) State the role of alkaline potassium permanganate in this reaction. What happens on adding it in excess?

(iii) Write chemical equation of this reaction.

Solution:

(i) 5 g potassium permanganate is dissolved in 100 ml of water for preparing 5 % solution of $KMnO_4$.

(ii) Alkaline potassium permanganate is adding oxygen to alcohol and converting that to an acid. Hence, it is acting as an oxidising agent. When $KMnO_4$ is added, initially colour disappears because coloured permanganate ions of potassium permanganate are consumed to oxidise ethanol. When an excess of $KMnO_4$ is added, colour does not change because there is no more alcohol left for the reaction.



Question 22

A squirrel is in a scary situation. Its body has to prepare for either fighting or running away. State the immediate changes that take place in its body so that the squirrel is able to either fight or run?

OR

Why is chemical communication better than electrical impulses as a means of communication between cells in a multi-cellular organism?

Solution:

Adrenaline hormone will be secreted in the body as the squirrel is in a scary situation. This will result in following immediate changes:

- Speeding up of heartbeat
- Rise in blood pressure
- Release of more glucose in the blood

OR

Chemical communication is better than electrical impulses as a means of communication in a multi-cellular organism because of following reason:

Chemical communication is mediated through hormones which can diffuse to different regions of the body, thereby, allowing cells to communicate even without physically interacting with each other. Moreover, this type of communication can be maintained at a steady rate and is easy to regulate.

Question 23

(a) State the relation correlating the electric current flowing in a conductor and the voltage applied across it. Also draw a graph to show this. relationship.

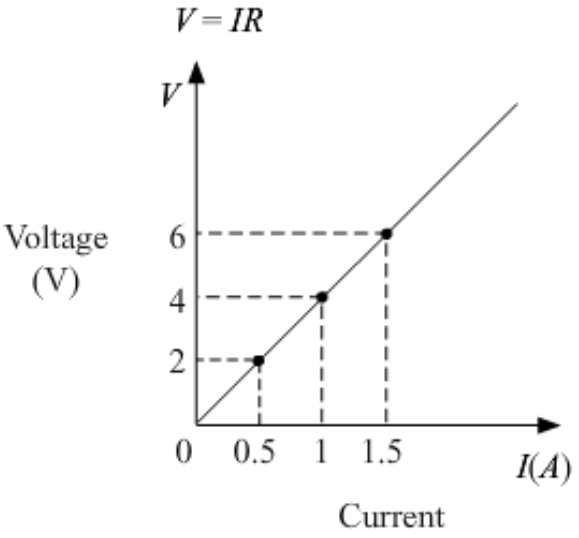
(b) Find the resistance of a conductor if the electric current flowing through it is 0.35 A when the potential difference across it is 1.4 V.

Solution:

a) V is directly proportional to I

V=IR This is called as the Ohm's law.

Graph:



b)

Given :

$\text{Potential Difference (V)} = 1.4\text{V}$

$\text{Current (I)} = 0.35\text{A}$

Now,

$\text{V} = \text{IR}$

$\text{so, R} = \frac{\text{V}}{\text{I}} = \frac{1.4}{0.35} = 4 \text{ ohm}$

Question 24

(a) Write the mathematical expression for Joule's law of heating,
(b) Compute the heat generated while transferring 96000 coulomb of charge in two hours through a potential difference of 40 V.

Solution:

(a)

The mathematical expression of Joules Law of heating is:

$$H = I^2Rt$$

Here, H is heating effect, I is current flowing through the device and t is time taken.

(b)

Given:

$Charge\ (Q) = 96000\ \text{C},\ \text{Time}\ (t) = 2\text{h},\ \text{Potential difference}\ (V) = 40\text{V}$

The heat generated,

$$H = VIt$$
$$= V \times \frac{Q}{t} \times t$$
$$= V \times Q$$
$$= 40 \times 96000$$
$$= 3840000 \text{ J}$$

Question 25

(a) What is thermit process? Where is this process used? Write balanced chemical equation for the reaction involved.
(b) Where does the metal aluminium, used in the process, occurs in the reactivity series of metals?
(c) Name the substances that are getting oxidised and reduced in the process.

Solution:

(a) In thermite reaction, iron oxide reacts with aluminium to produce molten iron. It is an exothermic process.

The following reaction of iron oxide with aluminium as:

$$\mathrm{Fe_2\,O_3(s)\ +\ 2\,Al\ (s)\ \rightarrow\ 2\,Fe\ (l)\ +\ Al_2\,O_3(s)\ +heat}$$

This is used to join railway tracks or cracked machine parts because the amount of heat evolved is so large that the metal is produced in the molten state.

(b) The reactivity series of metals as: K > Na > Ca > Mg > Al > C > Zn > Fe > Sn > Pb
As aluminium is more reactive than iron so it is placed above iron in the reactivity series.

(c) In this process, aluminium is getting oxidised to aluminium oxide and iron oxide is getting reduced to iron.

Question 26

(a)What is an electromagnet ? List any two uses.
(b) Draw a labelled diagram to show how an electromagnet is made.
(c) State the purpose of soft iron core used in making an electromagnet.
(d) List two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed.

Solution:

Draw a ray diagram in each of the following cases to show the formation of image, when the object is placed :

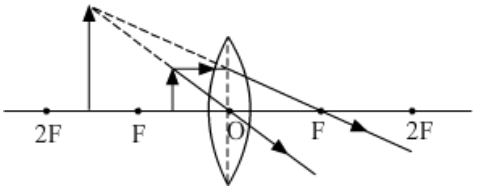
(i) between optical centre and principal focus of a convex lens.
(ii) anywhere in front of a concave lens.
(iii) at 2F of a convex lens.
State the signs and values of magnifications in the above mentioned cases (i) and (ii).

OR

An object 4.0 cm in size, is placed 25.0 cm in front of a concave mirror of focal length 15.0 cm.
(i) At what distance from the mirror should a screen be placed in order to obtain a sharp image?
(ii) Find the size of the image.
(iii) Draw a ray diagram to show the formation of image in this case.

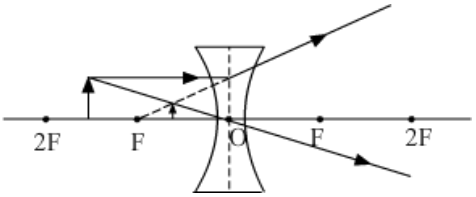
Solution:

(i) When an object is placed between optical centre and principal focus of a convex lens



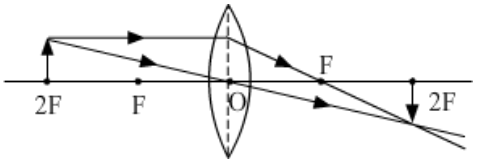
Since the image formed is virtual and erect so sign of magnification will be positive. Moreover, image formed is magnified therefore absolute value of magnification will be greater than one.

(ii) When an object is placed anywhere in front of a concave lens.



Since the image formed is virtual and erect so sign of magnification will be positive. Moreover, image formed is diminished therefore absolute value of magnification will be less than one.

(iii) When an object is placed at 2F of a convex lens.



OR

Given:
Height of object $(h_O) = 4$ cm
Object distance $(u) = -25$ cm
Focal length $(f) = -15$ cm

(i)

Applying mirror formula and substituting the values,
$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$
$\frac{1}{v} = \frac{1}{-15} - \frac{1}{-25}$
$\frac{1}{v} = \frac{-5+3}{75}$
$v = \frac{-75}{2} = -37.5$ cm
Negative sign indicates that the image is in front of the mirror.
Therefore, the screen must be placed in front of the mirror at a distance of 37.5 cm.

(ii)

Applying magnification formula and substituting the values,

$$m = \frac{-v}{u} = \frac{h_i}{h_o}$$

$$\frac{-\left(\frac{-75}{2}\right)}{-25} = \frac{h_i}{4}$$

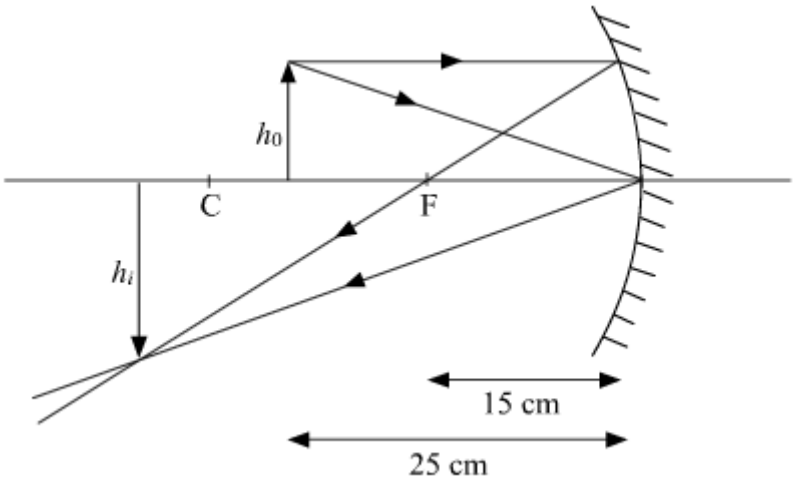
$$h_i = \frac{-75}{2 \times 25} \times 4$$

$$h_i = -6 \text{ cm}$$

Negative sign indicates that the image is below the principal axis.
Therefore, the size of the image is 6 cm.

(iii)

The ray diagram showing the formation of image in this case is,



Question 27

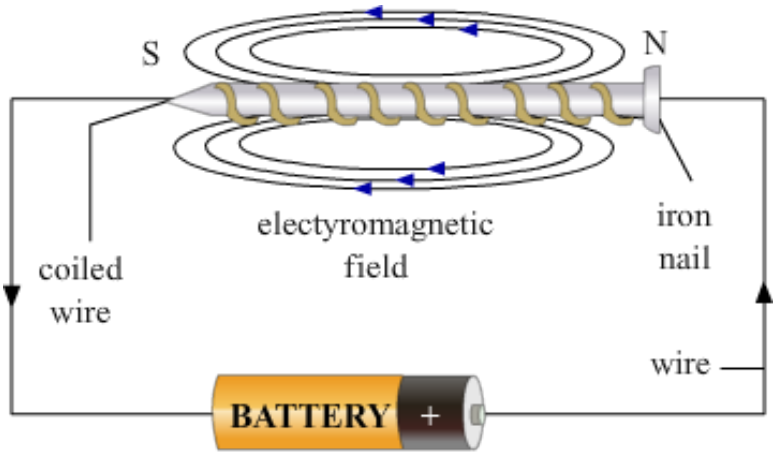
(a)What is an electromagnet ? List any two uses.
(b) Draw a labelled diagram to show how an electromagnet is made.
(c) State the purpose of soft iron core used in making an electromagnet.
(d) List two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed.

Solution:

a) The magnetic field produced due to the current flowing in a coil or a solenoid can be used to magnetize a material like soft iron temporarily. The insulated copper wire is wrapped on a soft iron piece. When current is passed through the coil using a battery and a key the iron piece behaves like a bar magnet as long as the current is being passed. Such a magnet is called an electromagnet.

Uses of Electromagnet :
1) Magnets are used inside TVs, Sound speakers, and radios.
2) Magnets are used inside a generator to transform mechanical energy to electrical energy

b) Diagram of Electromagnet:



An electromagnetic filed is formed when a current passes through the wire.

c) On placing a soft iron rod in a solenoid and passing a current, the magnetism of the solenoid is increased by a
thousandfold. When the solenoid current is switched off, the magnetism is effectively switched off since the soft iron core has a low retentivity.

d) Two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed:

i) By increasing the amount of current flowing in the solenoid, the strength of an electromagnet can be increased.

ii) By increasing the number of turns in the solenoid, the strength of an electromagnet can be increased.

Question 28

(a) What is genetics?
(b) What are genes? Where are the genes located?
(c) State and define three factors responsible for the rise of a new species.

Solution:

(a) Genetics is a branch of biology that deals with the study of genes, genetic variation and heredity in organisms.

(b) Genes are basic unit of hereditary. They are the means of passing characters/ traits from one generation to another. Genes are located on chromosomes. They are linear segments of DNA which codes for a gene product. They can be dominant or recessive depending upon how they express themselves.

(c) Species can be defined as a group of similar organisms that can interbreed to give rise to fertile off-springs. The process of the formation of new species from existing species is called speciation. The factors responsible for speciation include geographic isolation wherein, geographical barriers prevent interaction between species. Over a period of time, the sub-populations become more and more diversified from one another and finally form two different species.

The other factor includes genetic drift and natural selection. The accidental change in the

frequency of genes in a small population is called genetic drift. Natural selection can be defined as a process that results in the increased survival and reproductive success of individuals, who are well adapted to their environment.

Question 29

The position of certain elements in the Modern Periodic Table are shown below.

Group → / Period ↓	1	2	3 to 12	13	14	15	16	17	18
1	G								H
2	A			I			B		C
3		D			E				F

Using the above table answer the following questions giving reasons in each case :
(1) Which element will form only covalent compounds?
(ii) Which element is a non-metal with valency 2?
(iii) Which element is a metal with valency 2?
(iv) Out of H, C and F which has largest atomic size?
(v) To which family does H, C and F belong?

OR

Define atomic size. Give its unit of measurement. In the modern periodic table what trend is observed in the atomic radius in a group and a period and why is it so?

Solution:

(i) Element E is Silicon. It will form covalent bond only. The outermost orbit of silicon has four electrons and it needs four more electrons to become stable.
(ii) Non-metal with valency 2 is B, which is Oxygen. As Oxygen has a high electronegativity, due to which it has a higher tendency to attract electrons rather than donating them.
(iii) Element D is a metal with valency 2. Element D is magnesium, due to its low electronegativity it has a very high tendency to donate electrons.
(iv) Element F has the largest atomic size. According to the electronic configuration of element F which is argon, it occupies 3 energy shells compared to elements H and C which occupies one and two energy shells and due to this its atomic radius is the largest.
(v) Elements H, C and F belong to Group number eighteen, which means according to their outer electronic configuration their octet is complete and thus these elements are stable. They have a very low tendency to react with other elements. Group eighteen elements belong to the noble gas family.

OR

Atomic size is the distance between the center of an atom i.e. from the nucleus to the outermost shell (valence shell) of that atom.

Atomic size is measured in Angstroms ($\mathring{A}$), where $1\ \text{Angstrom} = 10^{-10}\ \text{meters}$.

In the modern periodic table, the atomic size of elements increases down the group and the atomic size decrease along the period from left to right.

Down the group, as the number of energy shells of the atoms keeps on increasing from top to bottom so, the atomic radius also increases.

Along the period, the atomic number of elements increases which leads to an increase in the number of protons inside the nucleus and thus, the effective nuclear charge increases. So, the atomic radius decreases along the period.

Question 30

(a) Why is there a difference in the rate of breathing between aquatic organisms and terrestrial organisms? Explain.

(b) Draw a diagram of human respiratory system and label - pharynx, trachea, lungs, diaphragm and alveolar sac on it.

OR

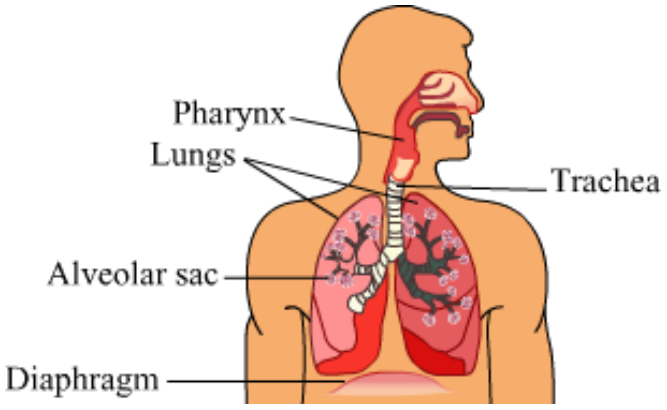
(a) Name the organs that form the excretory system in human beings.

(b) Describe in brief how urine is produced in human body.

Solution:

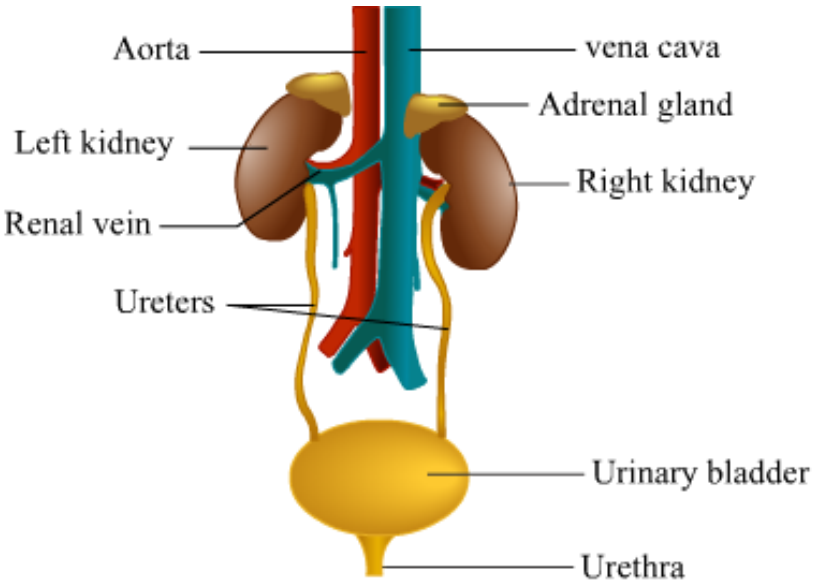
(a) The aquatic animals obtain oxygen in the dissolved form from the water. The amount of oxygen dissolved in water is much lower as compared to the amount of oxygen in the air (terrestrial environment) which necessitates high breathing rates in aquatic animals.

(b)



(a) The human excretory system is composed of the following organs:
1. A pair of kidneys
2. A pair of ureters
3. A urinary bladder
4. A urethra

The typical structure of human excretory system can be represented as follows:



(b) Blood enters the kidneys through the renal artery, which branches into many capillaries associated with the glomerulus. Water and other solutes are transferred at the Bowman's capsule. In the proximal tubule, some substances such as amino acids, glucose and salts are selectively re-absorbed and unwanted molecules are removed. In the loop of Henle, water is re-absorbed. From here, the filtrate moves upwards into the distal tubule, and on to the collecting duct. This duct collects urine from many nephrons.