Solution

Class 10 - Science

2020-21 paper 7

Section A

1. The substance (atom, ion or molecule) that gains electrons and is thereby reduced to a low valency state is called an oxidising agent, while the substance that loses electrons and is thereby oxidised to a higher valency state is called a reducing agent.
   $CuO + H_2 \rightarrow Cu + H_2O$
   Oxidizing agent : CuO
   Reducing agent : H_2

   OR

   $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
   The oxidation state of Oxygen is reduced, from 0 to -1. So Ammonia is reducing agent. Nitrogen and hydrogen are oxidized to a state of +2 and +1 respectively.
2. (i) The precipitate is yellow in colour and the compound is lead (II) Iodide (PbI_2).
   (ii) $Pb(NO_3)_2(aq) + 2KI(aq) \rightarrow PbI_2(s) + 2KNO_3(aq)$
   (iii) The reaction is an example of double displacement reaction.
3. **(a)** (i) - (d), (ii) - (a), (iii) - (c), (iv) - (b)
   Explanation:
   - **NaCl** has **ionic bonds** between the sodium ion and the chloride ion.
   - **Ammonia** has **polar covalent bonds** between the nitrogen atom and hydrogen atoms.
   - **Nitrogen** molecule has **non-polar covalent bonds** between the two nitrogen atoms since the two atoms are alike.
   - **C_{60}** is a member of **fullerenes** (Allotropes of carbon). Buckminsterfullerene contains a cluster of 60 carbon atoms joined together to form spherical molecules.
4. The absolute refractive index of glass = 1.5
   Refractive index of diamond with respect to glass n_{dg} = 1.6
   Refractive index of glass n_g =1.5
   Refractive index of diamond n_d = ?
   Refractive index of diamond with respect to glass
   $n_{dg} = \frac{n_d}{n_g}$
   So, the refractive index of diamond $n_d = n_{dg} \times n_g$
   or, $n_d = 1.6 \times 1.5 = 2.4$
   Hence, the refractive index of diamond is 2.4.
5. If the earth has no atmosphere, the sky would have appeared black because of no refraction.
6. Gypsum is calcium sulphate dihydrate. The chemical formula of gypsum is $CaSO_4 \cdot 2H_2O$.

   OR

   Sodium carbonate is used of softening hard water.
7. Because the resistivity of an alloy is higher than the pure metal.
8. f = 50 Hz and $T = f^{-1}$
   so, T = 1/50 sec
   or, T = 0.02 sec
   Now, in 0.02 sec, the current changes its direction = 2 times
   therefore, in 1 sec, the current changes its direction = 2/0.02 = 100 times
9. Unit of Resistance : $R = \frac{V}{I}$
   If V = 1 volt; I = 1 ampere then R = 1 ohm
   i.e. the resistance of a substance is 1 ohm (or 1 Ω) if 1 A of the current flows through it when a potential difference IV is applied across its ends.

OR

Electric cell is a device used to maintain a potential difference across the ends of a conductor. Chemical action within the cell generates the potential difference across the terminals of the cell. Cell expands the chemical energy stored in it to produce potential difference across two ends.

10. The role of the acid (HCl) in our stomach is as follows:
    i. Kills germs present in the food.
    ii. Makes the food acidic, so that pepsin can digest protein.
11. **Characteristics of respiratory surface:**
    i) It is thin walled and moist.
    ii) It is highly vascular.
    iii) Large surface area for gaseous exchange.
    iv) Direct or indirect contact with source of oxygen.

OR

Respiratory substrates are those organic substances which are oxidised during respiration to liberate energy inside the living cells. The common respiratory substrates are carbohydrates, proteins, fats and organic acids. The most common respiratory substrate is glucose.

12. CFCs (Chlorofluorocarbons) are group of chemical compounds that adversely affect ozone layer. There are various application of CFCs such as it is used as propellant in aerosol cans, refrigerators, air conditioner etc.

OR

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.

13. Movements shown by viruses are molecular movements.
14. **(c)** Assertion is CORRECT but, reason is INCORRECT.
    Explanation: Assertion is CORRECT but, reason is INCORRECT.
15. **(a)** Both A and R are true and R is correct explanation of the assertion.
    Explanation: Both A and R are true and R is correct explanation of the assertion.

OR

(a) Both A and R are true and R is correct explanation of the assertion.
Explanation: Both A and R are true and R is correct explanation of the assertion.

16. **(a)** Both A and R are true and R is correct explanation of the assertion.
    Explanation: Both A and R are true and R is correct explanation of the assertion.
17. i. (d) Right auricle $\rightarrow$ Right ventricle $\rightarrow$ Lungs $\rightarrow$ Left auricle $\rightarrow$ Left ventricle

    ii.

	carries blood to body	carries blood to lungs	carries blood from lungs	carries blood from body
(d)	3	1	4	2

    iii. (a) Aorta
    iv. (b) Haemoglobin
    v. (a) Left auricle and left ventricle
18. i. (b) Carbonic acid
    ii. (c) Baking soda
    iii. (c) $NaHCO_3$
    iv. (b) $Ca(OH)_2$
    v. (a) Washing soda
19. i. (d) 30 Ω
    ii. (d) all of these
    iii. (a) resistance decreases
    iv. (b) $10^{-8}\ \Omega$m to $10^{-6}\ \Omega$m
    v. (b) Alloys does not oxidise readily at high temperature
20. i. (b) Impure copper
    ii. (a) Insoluble impurities
    iii. (b) B and C

iv. (a) Cathode

v. (d) Ag

Section B

21. Mucus plays important role in digestive system. It prevents the inner lining of digestive system from becoming dry and helps in movement of food through the digestive system. Moreover, mucus in stomach protects the inner lining from damage by hydrochloric acid which is secreted by oxyntic cells of gastric gland to make environment acidic for pepsin to function. So, lack of mucus will result in damage to the inner lining of stomach by acid activity. It may result in gastric ulcers.

OR

Separation of oxygenated and deoxygenated blood helps in efficient supply of oxygen to the body. This system is useful in animals that have high energy requirement such as mammals and birds constantly need oxygen to get energy to maintain constant body temperature and homeostasis.

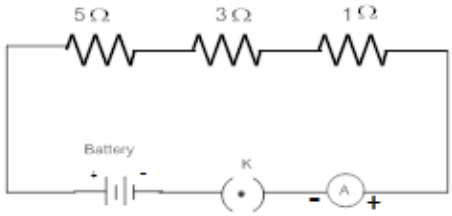
22. Root hairs have thin walls. Due to this, water enter s the root hairs because of osmosis. Water from root hairs continuously moves into the root xylem. To maintain the osmotic gradients, the cells of root hairs take up ions from the soil.
23. Detergents are the better cleansing agents than soaps because detergents work as a cleansing agent both in hard and soft water.

    Soaps are not suitable for use with hard water. The charged ends of detergents do not form insoluble precipitates with calcium and magnesium ions in hard water. Also, detergents produce more than soap.
24. The strength of an acid or base is measured on a scale of numbers called the pH scale. The pH scale has values from 0 to 14. The **pH** of a solution is inversely proportional to its hydrogen ion concentration. This means that the solution having lower pH will have more hydrogen ion concentration. Thus, **solution A** (pH = 6) will have more hydrogen ion concentration.

    pH less than 7 $\implies$ More H^+concentration; More acidic behaviour. A solution with pH < 7 is acidic. Hence, solution A is acidic.

    pH greater than 7 $\implies$ Lesser H^+concentration; More basic behaviour. A solution with pH > 7 is basic. Hence, solution B is basic.
25. i. A concave mirror forms an inverted image.A concave mirror can form a real and inverted image. When the object is placed very close to the mirror, the image formed is virtual, erect and magnified.

    ii. Rhea: Concern for her brother to give him the correct knowledge.
    Harnoor: Ability to learn and understand, respect for elders.

    iii. Concave mirror can be used as a shaving mirror.
26. 

27. i. **No**, it is not always necessary that a Bodybuilder's son will have a Robust body like Father.

    ii. It is an acquired character.

    iii. Rohit's friends are ignorant, ruthless, and have less knowledge of genetics.

OR

Fossils are the remains of the organism that once existed on earth. They represent the ancestors of the plants and animals that are alive today. They provide evidences of evolution by revealing the characteristics of the past organisms and the changes that have occurred in these organisms to give rise to the present organisms. Let us explain the importance of fossils in deciding evolutionary history with the help of the following example. Around 100 million years ago, some invertebrates died and were buried in the soil in that area. More sediment accumulated on top of it turning it into sedimentary rock. At the same place, millions of years later, some dinosaurs died and their bodies were buried on top of the sedimentary rock. The mud containing dinosaurs also turned into a rock. Then, millions of years later, some horse-like creatures died in that area and got fossilized in rocks above the dinosaur fossils. Sometime later, due to soil erosion or floods in that area, the rocks containing horselike fossils are exposed. If that area is excavated deeper, then the dinosaur and invertebrates fossils can also be found. Thus, by digging that area, scientists can easily predict that horse-like animals evolved later than the dinosaurs and the invertebrates. Thus, the above example suggests that

the fossils found closer to the surface of the earth are more recent ones than the fossils present in deeper layers.

28. Food chain starts with producers i.e. autotrophs. Carnivores cannot prepare their food by themselves, they are dependent on herbivores which in turn are dependent on producers who can photosynthesise and prepare their food with the help of sunlight.
29. Bile does not contain any enzyme but it is essential for digestion because bile is alkaline and contain salts which helps to emulsify the fat present in the food. So, the bile perform two functions:
    (a) The food coming from the stomach is acidic and has to be made alkaline for the pancreatic enzymes to act.
    (b) The bile salts breakdown the fat present in the food into smaller globules. This increases the efficiency of enzymes in the small intestine to digest the food effectively.
30. i. $Pb_3O_4 + HNO_3 \longrightarrow Pb(NO_3)_2 + PbO_2 + H_2O$ **[unbalanced]**

    $Pb_3O_4(s) + 4HNO_3(aq) \longrightarrow 2Pb(NO_3)_2(aq) + PbO_2(s) + 2H_2O(l)$ **[balanced]**

    ii. $C_2H_5OH + O_2 \longrightarrow CO_2 + H_2O$ + Heat **[Unbalanced]**

    $C_2H_5OH(l) + 3O_2(g) \longrightarrow 2CO_2(g) + 3H_2O(l)$ + Heat **[balanced]**

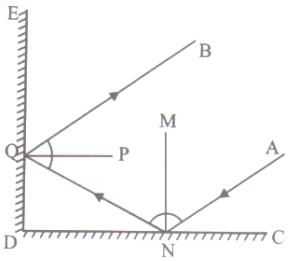
    iii. $Pb_3O_4 + HCI \longrightarrow PbCl_2 + Cl_2 + H_2O$ **[unbalanced]**

    $Pb_3O_4(s) + 8HCI(aq) \longrightarrow 3PbCl_2(aq) + Cl_2(g) + 4H_2O(l)$ **[balanced]**

31. i. The major constituent (metal) present in milk is Calcium(Ca). The other nutrients (metals) present in milk are magnesium (Mg), sodium (Na).
    ii. The chemical symbol of calcium = Ca
    Atomic number = 20, The electronic configuration of Ca = 2,8,8,2. Since it has 2 valence electrons, so its Valency is 2.
    iii. From the given text, we inferred the mother always possesses the values like knowledge and health concern for their children.
32. The chemical properties of an atom are largely determined by its valence electrons. In a given group, the number of valence electrons are same, hence they have similar properties. It is the electrons in the last shell that take part in the reaction .
33. The light-sensitive cells on retina are activated when the image is formed on it.
    The general electrical signals are transmitted to the brain through optic nerve.
    The brain, while interpreting and processing these signals, reinvert the image formed and we see the object erect.
    In this way, we see objects erect when the eye forms a real, inverted image of them on retina.
34. a. The four Characteristics of image formed by plane mirror:-
    (i) The image is same size as the object.
    (ii) The image is erect and virtual.
    (iii) The image is laterally inverted.
    (iv) The distance between the object and mirror is same as the distance between image and mirror.
    b. Given: height of object h = 5 cm, distance of object u = - 20 cm, focal length of mirror f = - 30 cm
    $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ (By using mirror formula)
    $\frac{1}{v} = \frac{1}{-30} - \frac{1}{-20}$
    v = 60 cm
    The image is formed at 60 cm on the backside of the mirror.
    Now, magnification $m = \frac{h'}{h} = -\frac{v}{u}$
    h' = 15 cm
    The size of the image is 15 cm

OR

When two plane mirrors are at 90^0 then incident ray and reflected ray will always be parallel as explained below:



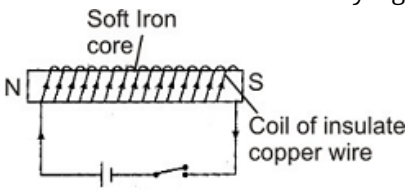
ED and DC are two plane mirrors placed at 90^0:
$\angle ANM = \angle MNQ$ (angle i=angle r)
$\angle NQP = \angle PQB$ (same as above)
$\angle MNQ + \angle QND = 90^\circ$ (MN is normal on CD) ...(1)
$\angle QDN = 90^\circ$ (mirrors are at right angle)
Hence, in ΔQDN;
$\angle QND + \angle NQD = 90^\circ$
(acute angles of a right triangle are complementary) ...(2)
From equations (1) and (2);
$\angle MNQ = \angle NQD$
Hence, $\angle QND = \angle NQP$
(because $\angle NQP$ and $\angle NQD$ are complementary)
Now, $\angle PQB$ and $\angle PQD$ are supplementary (PQ is normal on DE)
So, $\angle BQE = NQD = \angle MNQ = \angle ANM$
Or, $\angle BQE = \angle ANM$
Since corresponding angles are equal
Hence, $BQ \| AN$ proved
This means that incident ray and reflected ray will always be parallel; irrespective of value of angle of incidence.

35. The number of chromosomes in somatic cells of some organisms:

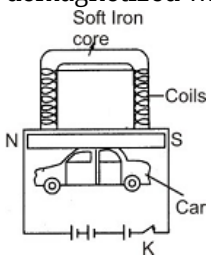
Organism	No. of Chromosomes
Human	46
Hare	48
Elephant	48
Cow	60
Dog	70
Kingfisher	132

a. The number of chromosomes is not related to the size of organisms. In the given table, we can see that even though Kingfisher is smaller in size than a dog, the number of chromosomes is more in Kingfisher.
b. Ease of reproduction is not dependent on the number of chromosomes present. It depends on other factors like the availability of water, nutrients, suitable mate, and a favorable environment.
c. More the number of chromosomes, the greater is the DNA content. DNA is the major component of chromosomes. Therefore, if the number of chromosomes is more, the amount of DNA will also be more.

36. Very strong electromagnets can be produced by binding an insulated copper wire on a soft iron core. Electromagnets work on the magnetic effects of electric current. We have studied in previous article that when a current is passed through a long solenoid, a magnetic field is produced. Now if a soft iron core is placed inside the solenoid, the strength of the magnetic field becomes very large. The reason for a large increase in magnetic field is due to the fact that iron gets magnetized by induction. The combination of soft iron core and a current carrying insulated copper wire wound over it is called an electromagnet.



A simple electromagnet is as shown in fig. To make an electromagnet, a soft iron core is taken and insulated copper wire is wound over it. The two ends of it are connected to a battery and a key. The electromagnet gets demagnetized when key is removed.

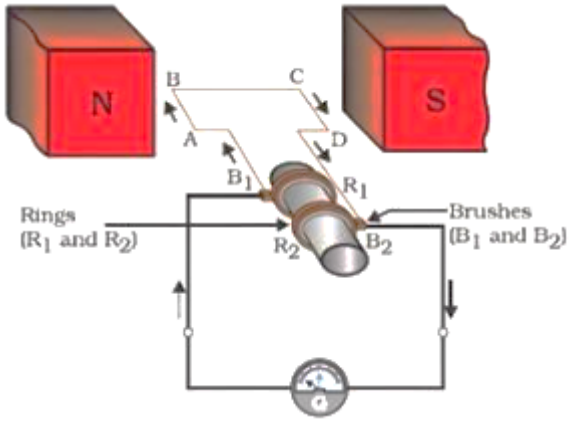


Strength of electromagnet depends upon

i. Number of turns. Strength of electromagnets is directly proportional to the number of turns.
ii. Current flowing. Larger the current flowing through the wire, stronger is the electromagnet. Strong electromagnets are used in cranes to lift the cars not obeying traffic rules.
iii. Length of the air gap. Lesser the length of air gap between poles, stronger is the electromagnet.

Air gap between the poles of a U-shaped electromagnet is small, hence it is very strong.

OR



An electric generator consists of a rotating rectangular coil ABCD placed between two poles of a permanent magnet. The coil ends are connected to the two rings R_1 and R_2. The inner sides of the ring are insulated. The stationary brushes B_1 and B_2 are kept pressed separately on rings R_1 and R_2. The rings are internally attached to the axle. The axle is mechanically rotated from outside to rotate the coil inside the magnetic field. The outer ends of the rings are connected to the galvanometer.

Working of Electric generator:

When the axle connected to the two rings is rotated, then the arm AB moves upward and CD moves downward in the magnetic field produced by the permanent magnet. Let the coil AB is rotated in a clockwise direction. Using Fleming's right-hand rule, the induced currents are set up in directions along with AB and CD and an induced current flow in ABCD.

If there are a large number of turns in the coil, then the current adds up in each current to give a large current. This means that the current in the external current flows from B_2 to B_1. After half-turn, arm AB moves in a downward direction, and CD moves in an upward direction. Now the direction of the induced current is reversed and now current flows in DCBA direction. The current now flows from B_1 to B_2. Thus, after every half rotation, the direction of the current reverses. This current is known as the alternating current which changes the direction of current periodically.

AC generator can be converted into a DC generator with the help of a split-ring commutator.