SCIENCE & TECHNOLOGY (PART 1)

SOLUTION : PRACTICE ACTIVITY SHEET 1

Q. 1. (A)

(i) (B)

(ii) (C)

(iii) (B)

(iv) (C)

(v) (B)

Q. 1. (B)

(i) Oxidation

(ii) False

(iii) Escape velocity — $\sqrt{\frac{2GM}{R}}$

(iv) Image behind the retina

(v) A convex lens

Q. 2. (A)

(i) (1) When an object is held in the hand, the gravitational force acting on the object due to the earth is balanced by the person holding the object.

(2) When the object is released from the hand, it falls on the earth due to the earth's gravitational force.

(ii) (1) The valency of an element is determined by the number of valence electron in the outermost shell of an atom of an element.

(2) All the elements in a group have the same number of valence electrons. Therefore, elements in the same group should have the same valency. For example, the elements of group I contain only one valence electron; the valency of elements of group I is one. Similarly for group II, the valency is two.

(iii) (1) Mica is a bad conductor of electricity and good conductor of heat.

(2) In an electric iron, the coil of high resistance is kept between mica sheets so that there is no electrical contact between the coil and the heavy metal block of the iron though there is heat transfer. This protects the user from getting an electric shock.

Q. 2. (B)

(i) Data : $m = 10$ kg, $\Delta T = 100\ ^\circ\text{C} - 30\ ^\circ\text{C} = 70\ ^\circ\text{C}$, $c = 1$ kcal/kg.°C

Heat energy to raise the temperature of water $= mc\Delta T$

$= 10 \times 1 \times 70$

$= 700$ kcal.

Quantity of heat required is 700 kcal.

(ii)

Reflection of light	Refraction of light
1. The rays of light, before and after reflection, travel in the same medium.	1. In refraction of light, the rays travel from one medium to another medium.
2. In reflection, the angle of incidence and the angle of reflection are equal.	2. In refraction, when the rays travel obliquely from one medium to another medium, the angle of incidence and the angle of refraction are not equal.
3. In reflection, there is no change in the speed and wavelength of light.	3. In refraction, there occurs a change in the speed and wavelength of light.
4. In reflection, there is no dispersion of light.	4. Generally, in refraction, there occurs dispersion of light.

(iii) Galvanizing :

(1) The process of coating a thin layer of zinc on iron or steel is called galvanization.

(2) In this method, corrosion of zinc occurs first because zinc is more electropositive than iron. After a few years zinc layer goes away and the iron layer gets exposed and starts rusting.

(3) In galvanization, an iron object is dipped into molten zinc. A thin layer of zinc is formed all over the iron object.

Examples : Shiny iron nails, pin, iron pipes.

(iv) Physical properties of ethanol :

(1) Ethanol is a colourless liquid and it is soluble in water in all proportions and has pleasant odour.

(2) The boiling point of ethanol is 78 °C and the freezing point is – 114 °C.

(3) It is combustible and burns with a blue flame.

(4) An aqueous solution of ethanol is neutral to litmus paper.

(v)

Type of satellite	Function of the satellite	Name of Indian satellite series
Earth observation satellite	**Study of forest, deserts, oceans, polar ice on earth surface**	IRS
Broadcast satellite	Telecasting TV Programmes	**INSAT AND GSAT**
Navigational satellite	**Fix the location of any place on earth surface**	IRNSS

Q. 3.

(i) (a) Element X is Sodium (Na); Element Y is Lithium (Li).

(b) Yes, these two elements belong to same group as they have same number of valence electrons.

(c) Element X is more electropositive than Y. This is because while going down the group, electropositivity increases with increase in atomic size.

(ii) (1) A chemical reaction takes place due to collisions of the reactant molecules. Higher the concentrations of the reactants more will be the frequency of collisions and faster will be the rate of the reaction.

(2) In the reaction of dil. HCl and $CaCO_3$, $CaCO_3$ disappears slowly and CO_2 also liberates slowly. On the other hand, the reaction with concentrated HCl takes place rapidly and $CaCO_3$ disappears fast.

(3) Concentrated acid reacts faster than dilute acid, that means the rate of a reaction is proportional to the concentration of reactants.

Slow reaction :

$CaCO_3 + \text{dil. } 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$

Fast reaction :

$CaCO_3 + \text{conc. } 2HCl \longrightarrow CaCl_2 + CO_2 + H_2O$

(iii)

Reactants	Products	Type of chemical reaction
$Fe + S$	FeS	**Combination**
$CuSO_4 + Zn$	$ZnSO_4 + Cu$	**Displacement**
$\mathbf{2Cu + O_2}$	$2CuO$	Oxidation
$HCl + NaOH$	$\mathbf{NaCl + H_2O}$	Neutralization
$NH_3 + HCl$	$\mathbf{NH_4Cl}$	**Combination**

(iv) Data : $m_1 = 80$ g, $T_1 = 45$ °C, $m_2 = 20$ g, $T = 42$ °C, $T_2 = ?$

According to principle of heat exchange, heat lost by hot water = heat gained by cold water

$\therefore m_1c\ (T_1 - T) = m_2c\ (T - T_2)$

$\therefore m_1T_1 - m_1T = m_2T - m_2T_2$

$\therefore m_2T_2 = (m_1 + m_2)\ T - m_1T_1$

$$\therefore T_2 = \frac{(m_1 + m_2)\ T - m_1T_1}{m_2}$$

$$= \frac{(80\text{ g} + 20\text{ g}) \times 42\text{ °C} - 80\text{ g} \times 45\text{ °C}}{20\text{ g}}$$

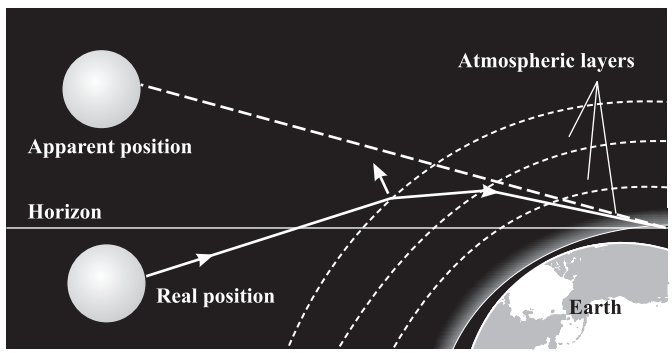
$$= \left(\frac{100 \times 42 - 80 \times 45}{20}\right)\text{°C}$$

$$= \left(\frac{420 - 360}{2}\right)\text{°C} = \frac{60}{2}\text{ °C} = 30\text{ °C}$$

This is required temperature.

(v) (1) The sunrise (the appearance of the sun above the horizon) is advanced due to atmospheric refraction of sunlight. An observer on the earth sees the sun two minutes before the sun reaches the horizon. A ray of sunlight entering the earth's atmosphere follows a curved path due to atmospheric refraction before reaching the earth. This happens due to a gradual variation in the refractive index of the atmosphere. For the observer on the earth, the apparent position of the sun is slightly higher than the actual position. Hence, the sun is seen before the sun reaches the horizon.

(2) Increased atmospheric refraction of sunlight occurs also at the sunset (the sun disappearing below the horizon). In this case, the observer on the earth continues to see the setting sun for two minutes after the sun has dipped below the horizon, thus delaying the sunset. *(Figure for reference only.)*



Effect of atmospheric refraction

The advanced sunrise and delayed sunset increases the duration of day by four minutes.

(vi) (a) Compound microscope :

(b) Working :

(1) The object to be observed is illuminated and placed in front of the objective lens, slightly beyond the focal length of the objective lens. Its real, inverted and enlarged image is formed by the objective lens on the other side.

(2) This intermediate image lies within the focal length of the eyepiece. It serves as an object for the eyepiece. The eyepiece works as a simple microscope. The final image is virtual, highly enlarged and inverted with respect to the original object. It can be formed at the minimum distance of distinct vision from the eyepiece. The final image is observed by keeping the eye close to the eyepiece.

(c) Uses of a compound microscope :

(1) It is used to observe blood corpuscles, plant and animal cells, microorganisms like bacteria, etc.

(2) It is used in a pathological laboratory to observe blood, urine, etc.

(3) It is a part of a travelling microscope used for measurement of very small distance.

(vii) (1) During electrolysis of alumina, carbon rods are used as anodes.

(2) During electrolysis of alumina, the oxygen liberated at the carbon anode reacts with graphite rods (carbon anode) and forms carbon dioxide (while aluminium is deposited at cathode).

(3) As the anodes gets oxidized during electrolysis of alumina, they are continuously eroded. Hence, it is necessary to replace anodes from time to time.

(viii) (1) In a space, nonessential objects such as the parts of launchers and satellites, revolving around the earth are called the debris in space.

(2) The debris can be harmful to the artificial satellites. It can collide with the satellites or spacecrafts and damage them.

(3) Therefore the future of artificial satellites or spacecrafts are in danger. Hence, it is necessary to manage the debris.

Q. 4.

(i) (a) The potential difference between the live wire and the neutral wire is 220 V.

(b) If a bare live wire (phase wire) and a bare neutral wire touch each other (come in direct contact) or come very close to each other, the resistance of the circuit becomes very small and hence huge (very high) electric current flows through it. This condition is called a short circuit or short circuiting.

(c) A fuse protects electrical circuits and appliances by stopping the flow of electric current when it exceeds a specified value. For this, it is connected in series with the appliance (or circuit) to be protected. A fuse is a piece of wire made of an alloy of low melting point (e.g. an alloy of lead and tin). If a current larger than the specified value flows through the fuse, its temperature increases enough to melt it. Hence, the circuit breaks and the appliance is protected from damage.

(d) The earth wire is connected to ground.

(e) During short circuit, a large amount of heat is produced and the temperature of the components involved becomes very high. Hence, the circuit catches fire.

(ii) (a) The reaction in which the place of one type of atom/group in a reactant is taken by another atom/group of atom, is called substitution reaction. Chlorination of methane is a substitution reaction.

(b) (1) $CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} \underline{CH_3 - Cl} + HCl$

(2) $CH_3Cl + Cl_2 \xrightarrow{\text{Sunlight}} \underline{CH_2Cl_2} + HCl$

(3) $\underline{CH_2Cl_2} + Cl_2 \xrightarrow{\text{Sunlight}} CHCl_3 + HCl$

(4) $CHCl_3 + Cl_2 \xrightarrow{\text{Sunlight}} \underline{CCl_4} + HCl$