Maharashtra State Board
Class X
Science and Technology
Paper – I Solutions

1.

(A)

(i) False.

The force of gravitation experienced on the Moon is $(1/6)^{th}$ of that experienced on the Earth.

(ii) **Sodium** is the alkali metal present in the third period.

(iii) Conversion of ferrous sulphate to ferric sulphate is an **oxidation** reaction.

(iv) Ammeter is the odd one. The ammeter is a device used to measure electricity, whereas all the others are SI units.

(v) Education: EDUSAT :: Survey and map making: **CARTOSAT**

(B)

(i) Option (d)

The escape velocity is given by $\sqrt{\frac{2GM}{R}}$

(ii) Option (c)

When $\mathbf{CO_2}$ is passed through fresh lime water, it turns milky.

(iii) Option (b)

At the time of a short circuit, the current in the circuit increases exceedingly.

(iv) Option (c)

The speed of light in a medium of refractive index 'n' is $\frac{c}{n}$, where 'c' is the speed of light.

(v) Option C

Ore is used to extract metal which is economically profitable.

2.

(i)

a) Aqua regia is a fuming and corrosive liquid of a mixture of conc. HCl and conc. HNO_3 in the ratio of 3:1.

b) It is a reagent which can dissolve the noble metals such as gold and silver.

(ii) Given:

u = -60 cm

v = -20 cm

f = ?

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{f} = \frac{1}{-20} - \frac{1}{-60}$$

$$\frac{1}{f} = -\frac{1}{30}$$

The focal length of the lens, f = -30 cm.

As the focal length is negative, it is a diverging lens.

(iii)

a) In hypermetropia, a human eye can see distant objects distinctly but is unable to see nearby objects clearly.

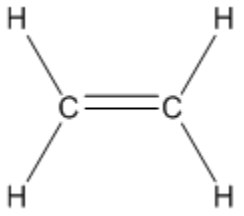
b) In such a case, the image of a nearby object would be formed behind the retina.

c) For normal vision, the image should be formed at the retina and neither before nor behind it.

d) This defect can be corrected using a convex lens of appropriate power.

(iv)

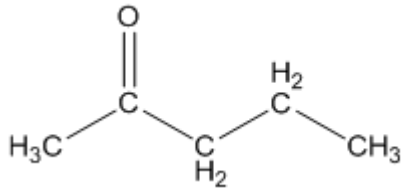
a) Unsaturated hydrocarbons have double or triple bonds between two carbon atoms.

b) 

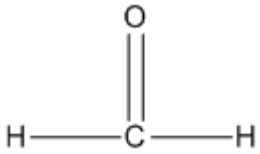
Ethylene contains a double bond between two carbon atoms. Hence, ethylene is an unsaturated compound.

(v)

a)



b)



(vi) When steam is passed over aluminium, hydrogen and aluminium oxide are formed.

$$2Al + 3H_2O \longrightarrow Al_2O_3 + 3H_2\uparrow$$

Aluminium Steam Aluminium oxide Hydrogen

(vii)

a) A TV centre or studio transmits a TV programme that first reaches a satellite.
b) The dish antenna of the cable operator in the area receives the signals reflected from the satellite.
c) These signals reach the TV set through a cable connected between the cable operator's receiving station and the TV set.
d) On the other hand, in a different process, a small portable dish antenna fixed on the rooftop is also used to receive TV signals directly from the satellite.
e) The dish antenna and the TV set are also connected by a cable to transmit the signals.

3.

(i)

Kepler's law states that the square of the period of revolution of a planet around the Sun is directly proportional to the cube of the mean distance of the planet from the Sun.

If 'r' is the average distance of the planet from the Sun and T is its period of revolution, then

$T^2 \propto r^3$

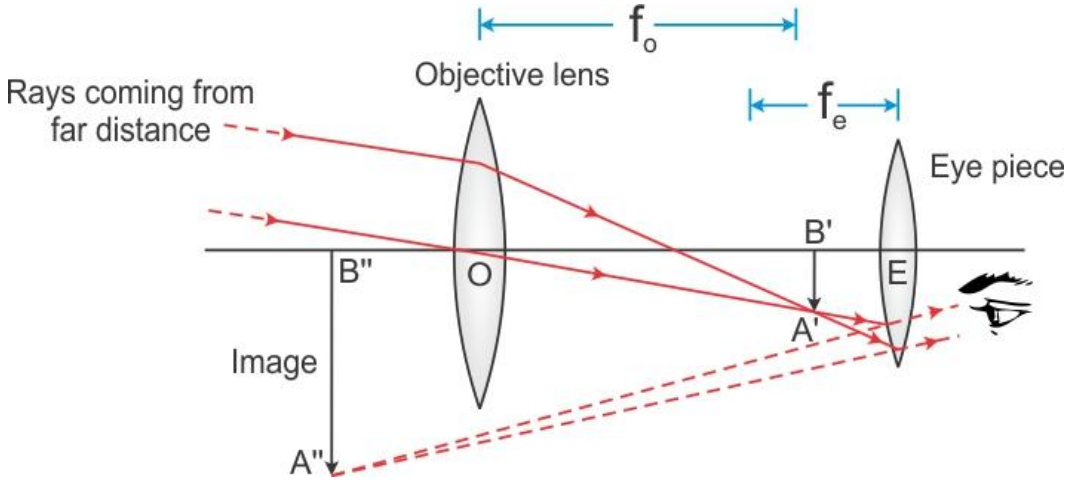
$\frac{T^2}{r^3}$ = constant =K

(ii) Given:
m= 5 kg,
c = 1 kcal/kg o C and
Change in temperature ΔT = 100 - 25 = 75°C
Energy to be supplied to water = energy gained by water
Energy to be supplied to water = mass of water (m) x specific heat of water (c) x change in temperature of water (ΔT)
Energy to be supplied to water = m x c x ΔT
Energy to be supplied to water = 5 x 1 x 75^{o} = 375 kcal
Hence, heat energy necessary to raise the temperature of water =400kcal

(iii)

a) We are able to see objects because the lens of the eye creates the image on the retina.
b) The image stays on the retina as long as the object is in front of us.
c) As soon as the object is taken away, the image disappears.
d) However, the image does not disappear instantly.
e) The image remains imprinted on our retina for 1/16th of a second even after the object is removed.
f) The sensation of that image on the retina persists for a while. This is called persistence of vision.

(iv)



a) A telescope is an optical device that is used to see distant objects clearly in their magnified form.
b) Telescopes used to observe astronomical bodies like stars and planets are called astronomical telescopes.
c) On the basis of their optical property, telescopes are of two types: a refracting telescope (which uses lenses) and a reflecting telescope (which uses both mirrors and lenses).
d) In both of these, the image formed by the objective acts as an object for the eye piece which forms the final image.
e) The objective lens has a large diameter and a larger focal length because of which the maximum amount of light coming from the distant object can be collected.

(v)

a) $CH_4 + O_2 \rightarrow CO_2 + H_2O$ + heat and light

b) $C_2H_5OH \xrightarrow{\text{Hot conc.}H_2SO_4} CH_2=CH_2 + H_2O$

c) $NaOH + CH_3COOH \rightarrow CH_3COONa + H_2O$

(vi)

a) CH_4, C_2H_6 and C_3H_8 are alkanes as they have each carbon bonded to four other atoms through single covalent bonds and follow the general formula C_nH_{2n+2}.

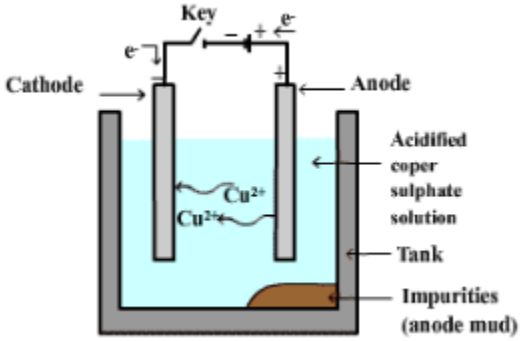
b) C_2H_4 and C_3H_6 are alkenes since they contain a single carbon-carbon double bond and follow the general formula C_nH_{2n}.

c) C_3H_4, C_2H_2 and C_4H_6 are alkynes as they contain a single carbon-carbon triple bond and follow the general formula C_nH_{2n-2}.

(vii)

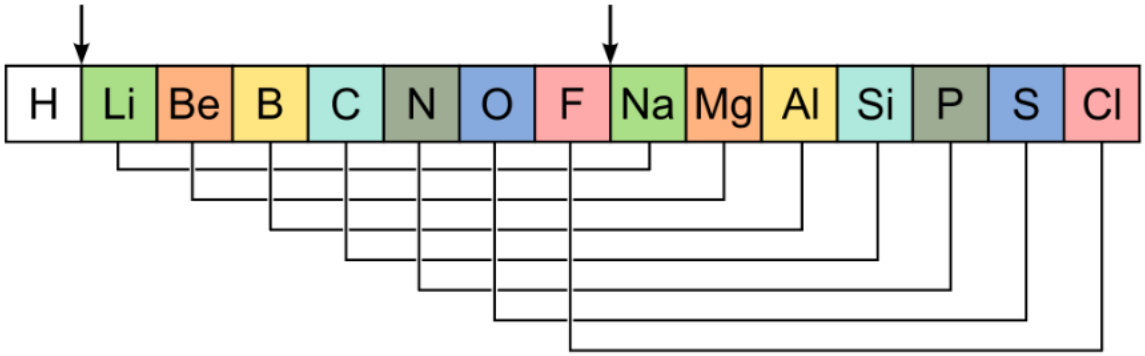
Electrolytic refining: Many metals such as copper, zinc, tin, nickel, silver and gold are refined by electrolysis. In this process, the impure metal is made the anode and a thin strip of pure metal is made the cathode. The solution of the metal salt is used as an electrolyte. When current passes through the electrolyte, the pure metal from the anode dissolves into the electrolyte. An equivalent amount of pure metal from the electrolyte is deposited on the cathode. The insoluble impurities settle at the bottom of the anode and are known as anode mud, whereas the soluble impurities go into the solution.

Example: In the electrolytic refining of copper, the electrolyte is a solution of acidified copper sulphate. The anode is impure copper, whereas the cathode is a strip of pure copper. On passing electric current, pure copper is deposited on the cathode.



4.

(i) Law of Octaves: When elements are arranged in the increasing order of their atomic masses, the properties of every eighth element are similar to the first.



Limitations:

a) Out of the total 56 elements known, Newlands could arrange elements only up to calcium.
b) After calcium, every eighth element did not possess properties similar to that of the first.
c) Only 56 elements were known at the time of Newlands, but later several new elements were discovered.
d) To fit the existing element arrangement, Newlands placed two elements in the same position which differed in their properties.
e) Example: Iron, an element which resembles cobalt and nickel in its properties, is placed far away from these elements.
f) The periodic table did not include inert gases because they were not discovered then.

(ii)

a) In Fleming's left-hand rule, we consider the direction of the electric current and the direction of the magnetic field along with the direction of the force exerted which is perpendicular to each other.
b) According to this rule, the left hand thumb, index finger and middle finger are stretched to be perpendicular to each other.
c) If the index finger is in the direction of the magnetic field and the middle finger points in the direction of the current, then the direction of the thumb is the direction of the force on the conductor.
d) This rule is significant in the applications of electromagnetic induction.
e) Electromagnetic induction is the production of electricity using electromagnets.
f) It is found that for a given area, if the magnetic field is changing, then electric current is generated. This is called induced current.