Maharashtra State Board
Class X Science and Technology Paper I
Board Paper - 2018

Time: 2 hrs **Max. Marks: 40**

Note:

i. Draw well-labelled diagrams wherever necessary.
ii. All questions are compulsory.
iii. Student should write the answers of question in sequence.

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1. (A)

(a) Rewrite the following statements with suitable words in the blanks. [2]

(i) 1 calorie = ……. Joule.
(ii) The arrangement of elements in a group of three is known as …….

(b) State whether the following statements are true or false: [2]

(i) Pollen, Bacteria, Fungal spores are also pollutants.
(ii) Magnetic lines of force always cross each other.

(c) Taking into consideration the relationship in the first pair, complete the second pair: [1]

$2H_2 + O_2 \rightarrow 2H_2O$: Combination Reaction : $2HgO \rightarrow 2Hg + O_2$: …….

(B) Rewrite the following statements by selecting the correct options: [5]

(1) When crystals of copper sulphate are strongly heated, the residue obtained is ……..
(a) red in colour
(b) blue in colour
(c) green in colour
(d) colourless

(2) Which type of mirror is used by a dentist?
(a) Plane
(b) Convex
(c) Concave
(d) Both (b) and (c)

(3) The equivalent resistance of the parallel combination of two resistors of 60 Ω and 40 Ω is …….
(a) 24 Ω
(b) 100 Ω
(c) 50 Ω
(d) 240 Ω

(4) The litmus paper or the litmus solution is obtained from ……..plant.
   (a) Moss
   (b) Lichen
   (c) Rose
   (d) Hibiscus

(5) Which substance when used with butter having butyric acid can cure acidity?
   (a) Lime water
   (b) Soda water
   (c) Calcium carbonate
   (d) Lime juice

2. State any five of the following: [10]

(1) State Newlands law of Octaves.
(2) State the right hand thumb rule.
(3) If a bulb of 60 W is connected across a source of 220V, find the current drawn by it.
(4) Draw a neat and labelled diagram of structure of the human eye.
(5) Define:
   (a) Radius of curvature of spherical mirror
   (b) Focal length of spherical mirror.
(6) Give scientific reason:
   The sun appears reddish early in the morning.

3. Answer any five of the following: [15]

(1) Write the merits of the modern periodic table over Mendeleev's Periodic table.
(2) What is redox reaction? Explain with one example.
(3) What is Resistivity? Write the formula of resistivity. Write the SI unit of resistivity.
(4) Distinguish:
   Degradable pollutants - Non-degradable pollutants. (any three points)
(5) Kavita from 10^{th} is using spectacles. The power of the lenses in her spectacles is –2.5 dioptre. Answer the following questions:
   (a) Which lenses are used in her spectacles?
   (b) State the defect of vision Kavita is suffering from.
   (c) Find the focal length of the lenses used in her spectacles.
(6) Write the chemical name of bleaching powder and write its properties.

4. Answer any one of the following: [5]

(A) Explain the construction and working of an electric motor.
(B) What is refraction of light? Draw the diagram of refraction of light in glass slab. Write the laws of refraction.

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1.

(A)

(a)

(i) 1 calorie = **4.184** joules

(ii) The arrangement of elements in a group of three is known as a **triad**.

(b)

(i) True.

(ii) False. Magnetic lines of force never intersect each other.

(c) $2H_2 + O_2 \rightarrow 2H_2O$: Combination Reaction ::
$2HgO \rightarrow 2Hg + O_2$: **Decomposition Reaction**

(B)

(1) (d) Colourless
Crystals of copper sulphate are strongly heated and the residue obtained is colourless.

(2) (c) Concave mirror
Dentists use a concave mirror in order to obtain the large images of the teeth.

(3) (a) $24\,\Omega$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_{eq}} = \frac{1}{60} + \frac{1}{40} = 0.041$$

$$\Rightarrow R_{eq} = \frac{1}{0.041} = 24\Omega$$

(4) (b)Lichen
Litmus paper or litmus solution is obtained from lichens.

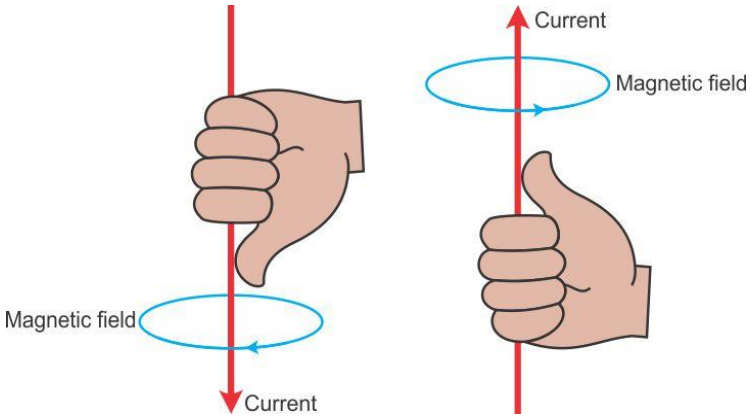
(5) (a) Lime water
Lime water when used with butter having butyric acid can cure acidity.

2.

(1) **Newland's law of octaves:**

When elements are arranged in the increasing order of atomic masses, the properties of every eighth element are similar to the first.

(2)



Right-Hand Thumb Rule: Imagine that you are holding a current-carrying straight conductor in your right hand such that the thumb points towards the direction of the current. Then, your fingers will wrap around the conductor in the direction of the field lines of the magnetic field.

(3)

Power of light bulb (P)=60W

P.D. across the bulb= 220V

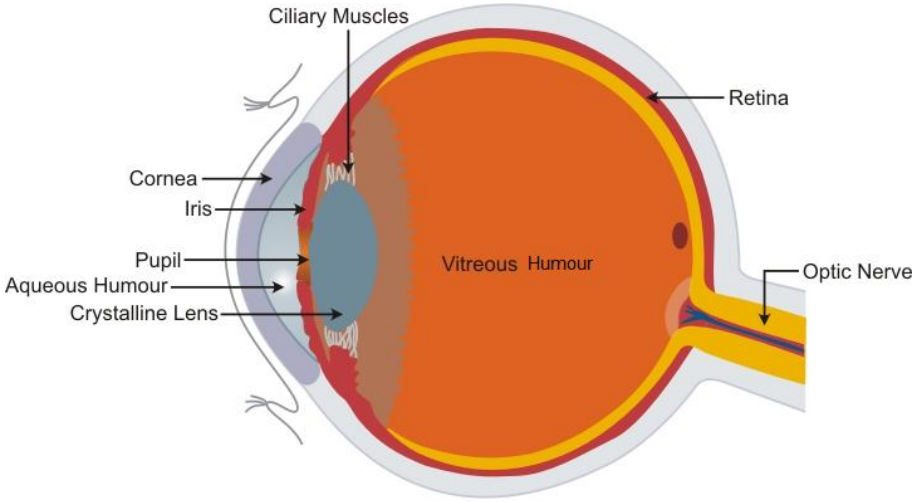
thus the current drawn by the bulb is given by,

$P = V \times I$

$60 = 220 \times I$

$\therefore I = \frac{60}{220} = 0.27A$

(4)



(5)

a) **Radius of curvature of a spherical mirror:**
The radius of curvature (R) of a spherical mirror is the radius of the hollow sphere of glass of which the spherical mirror is a part.

b) **Focal length of a spherical mirror:**
The focal length of a spherical mirror is the distance between its pole (P) and its principal focus (F).

(6) Atmospheric refraction is the phenomenon of bending of light on passing through the Earth's atmosphere. This is because the upper layers of the Earth's atmosphere are rarer compared to the lower layers.
i) During sunrise and sunset, sunlight travels a greater distance through the atmosphere.
ii) Because of this, blue light is scattered more than red light and it directly enters our eyes.
iii) Hence, the sky and Sun appear red during sunrise and sunset.

3.

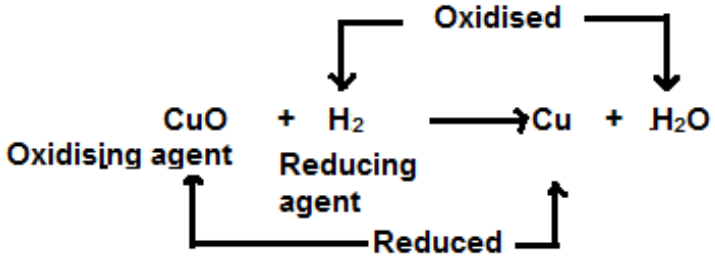
(1) **<u>Merits of the modern periodic table over Mendeleev's periodic table:</u>**

(i) All isotopes of the same element have different masses but the same atomic number. Hence, they occupy the same position in the modern periodic table.

(ii) Elements are classified according to their electronic configuration into four blocks such as s-block, p-block, d-block and f-block.

(iii) In the modern periodic table, the elements are arranged according to their atomic numbers; therefore, the anomaly of elements such as cobalt and nickel in Mendeleev's periodic table disappears.

(2) <u>Redox reaction</u>
A redox reaction is a chemical reaction in which oxidation and reduction take place simultaneously.
<u>Example:</u>



(3)

Resistivity of a substance is numerically equal to the resistance of a rod of that substance which is 1 metre long and 1 square metre in cross-section.

$$\rho = R\frac{A}{l}$$

$R \rightarrow$ Resistance

$A \rightarrow$ Area of cross-section

$l \rightarrow$ length of wire

The SI unit of resistivity is ohm metre (**Ωm**).

(4) **Differences between degradable and non-degradable pollutants:**

Degradable pollutants	Non-degradable pollutants
1. They can degrade on their own over a period of time.	1. They cannot degrade on their own.
2. They are acted upon by microorganisms and are converted to inorganic substances.	2. They are not acted upon by microorganisms and so exist in the complex form only.
3. They do not get accumulated in nature.	3. They get accumulated in nature and persist for a long time.
4. They emit foul odour when they are being decomposed.	4. They do not emit foul odour as they are not decomposed.
5. Examples: Vegetables, fruits, organic matter	5. Examples: Metals, plastic, glass

(5)

a) The power of the lens used in spectacles is −2.5 D. The negative sign indicates that the lens used is a concave lens.

b) A concave lens is used to correct the defect called myopia. Hence, Kavita is suffering from **myopia** or **short-sightedness**.

c)

We know that

$$\text{Power of lens (P)} = \frac{1}{\text{focal length (in metres)}}$$

$$\therefore f = \frac{1}{-2.5\ D} = 0.4\ m = 40\ cm$$

Thus, the focal length of the lens is 40 cm.

(6) Molecular formula of bleaching powder is $CaOCl_2$. (Calcium oxychloride)

Properties:

(i) Bleaching powder is a yellowish white coloured solid substance.

(ii) Its chemical name is calcium oxychloride.

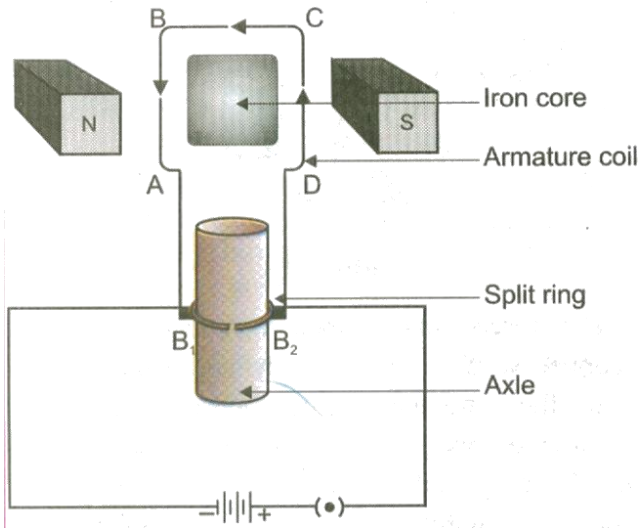
(iii) It has a strong odour of chlorine gas.

(iv) Dilute sulphuric acid and dilute hydrochloric acid react rapidly with bleaching powder to release chlorine gas completely.

$$CaOCl_2 + H_2SO_4 \rightarrow CaSO_4 + Cl_2 \uparrow + H_2O$$

4.

(1)



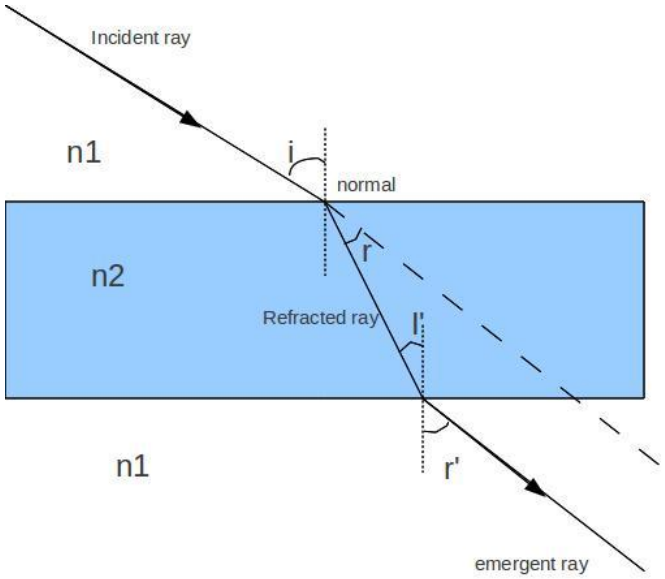
Construction of an electric motor:

- The electric motor consists of a rectangular coil ABCD of insulated copper wire mounted between the poles of a horseshoe magnet so that it can freely rotate between the N and S poles. The coil along with the magnet is called armature.
- A device called commutator or split ring reverses the current.
- There are carbon brushes B1 and B2 fixed at the base of the motor.

Working of an electric motor:

- The rectangular coil is placed in the magnetic field and current is passed through it. Thus, the force acts on it and it causes the motor to rotate continuously.
- The commutator reverses the direction of current flowing through the coil every time when the coil passes the vertical position during revolution.
- The carbon brushes make contact with the rotating rings of the commutator and then supply the current to the coil.
- The rotating shaft of the electric motor can drive a large number of machines which are connected to it.

(2) The phenomenon of change in the path of light while going from one medium to another is called refraction of light.



<u>Laws of refraction</u>:

(i) The incident ray, the refracted ray and the normal to the interface of two media at the point of incidence lie in the same plane.

(ii) The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given pair of media.

$$\frac{\sin i}{\sin r} = \text{constant} = {}^{1}n_{2}$$

This law is also known as Snell's law.

The constant written as ${}^{1}n_{2}$ is called the refractive index of the second medium (in which the refracted ray lies) with respect to the first medium (in which the incident ray lies).