

Maharashtra State Board
Class X Science and Technology Paper I
Board Paper – 2016

Time: 2 Hours

Max. Marks: 40

Note:

- (i) Draw well-labelled diagrams wherever necessary.
 - (ii) All questions are compulsory.
 - (iii) Students should write the answers of questions in sequence.
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1.

(A)

(1) Fill in the blanks:

3

- (i) The modern periodic table consists of periods.
- (ii) The formulae of chloride of metal M is MCl_2 . The metal M belongs to group.
- (iii) Corrosion can be prevented by using solution.

(2) Find the odd one out:

2

- (i) Voltmeter, ammeter, galvanometer, thermometer.
- (ii) Loudspeaker, bar magnet, electric motor, microphone.

(B) Choose the correct alternative and rewrite the following:

5

- (1) Reaction of iron nails with copper sulphate solution is an example of
 - (a) Combination reaction
 - (b) Decomposition reaction
 - (c) Displacement reaction
 - (d) Double displacement reaction
- (2) Dilute NaOH can be tested with
 - (a) red litmus paper
 - (b) blue litmus paper
 - (c) lime water
 - (d) Na_2CO_3
- (3) In series combination which remains constant?
 - (a) Voltage
 - (b) Current
 - (c) Both current and voltage
 - (d) Both are variables

(4) An object of 10 cm is placed in front of a plane mirror. The height of image will be

- (a) 5 cm
- (b) 15 cm
- (c) 20 cm
- (d) 10 cm

(5) When a ray of light travels from air to glass slab and strikes the surface of separation at 90° , then it

- (a) bends towards normal
- (b) bends away from normal
- (c) passes unbent
- (d) passes in zigzag way

2. Answer the following questions (any five):

5×2=10

(1) Define the following:

- (i) 1 volt PD
- (ii) Electric power

(2) What major harm is done to the human beings by air pollution?

(3) Calculate the focal length of a corrective lens having power +2D.

(4) Write two applications of sodium bicarbonate (baking soda).

(5) A simple microscope is used by watch repairers. Give reason.

(6) Draw neat and labelled diagram of pH scale.

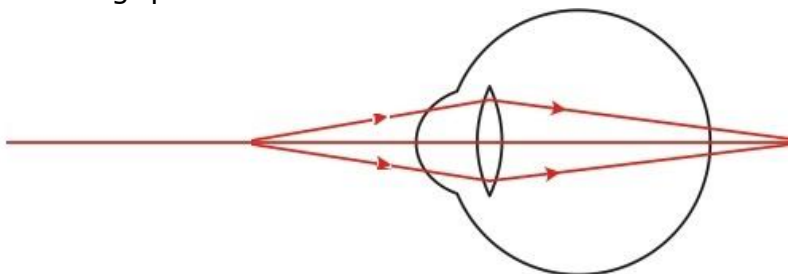
3. Answer the following questions (any five):

5×3=15

(1) What are the main features of Mendeleev's periodic table?

(2) Define 'redox reaction'. Give one example.

(3) Given below is a diagram showing a defect of human eye. Study it and answer the following questions.



(i) Name the defect shown in the figure.

(ii) Give reason for this defect of eye in human being.

(iii) Name the type of lens used to correct the eye defect.

(4) What is refraction of light? How is it related to refractive index?

(5) Explain how spectrum is formed.

(6) Suggest measures in the following situations:

- (i) To avoid noise pollution in classroom.
- (ii) To minimize electricity consumption at home.
- (iii) Bursting fire crackers in festivals and processions.

4. Answer any one of the following questions:

5

- (1) Find the expression for the resistors connected in series and write the two characteristics of it. (Draw figure).
- (2) Explain 'Electric motor' with the help of the following points:
 - (i) Draw figure
 - (ii) Principle of Electric motor
 - (iii) Name any four appliances where electric motor is used.

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1.

(A)

(1)

- (i) The modern periodic table consists of **7** periods.
- (ii) The formula of the chloride of metal M is MCl_2 . Metal M belongs to the **2nd** group.
- (iii) Corrosion can be prevented by using **anti-rust** solution.

(2)

(i) thermometer

A thermometer is a device used for measuring temperature. The other devices are used to measure current and potential difference in a circuit.

(ii) bar magnet

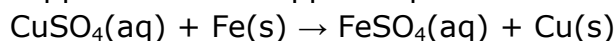
In the other devices, one form of energy is converted to another form of energy.

(B)

(1) (c) Displacement reaction

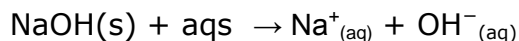
When a more reactive element removes another element having less reactivity from its compound, the reaction is termed a displacement reaction.

In the reaction of iron nails with copper sulphate solution, iron displaces copper from the copper sulphate solution.



(2) (a) red litmus paper

Sodium hydroxide when dissolved in water undergoes the following reaction:



The dissociated OH^- ions turn moist red litmus paper blue.

(3) (b) Current

When a potential difference is applied across a combination of resistors in series, the same current flows through each resistor.

(4) (d) 10 cm

The image formed by a plane mirror is always of the same size as that of the object.

(5) (c) passes unbent

In this case, the angle of incidence (i) is zero and so also the angle of refraction.

2.

(1)

(i) The potential difference between two points is said to be 1 volt if 1 joule of work is done in moving 1 coulomb of electric charge from one point to another.

$$1 \text{ volt (V)} = \frac{1 \text{ joule (J)}}{1 \text{ coulomb (C)}}$$

(ii) Electric power is the electric work done per unit time. Its SI unit is watt (W).

$$\text{Electric power (P)} = \frac{\text{Electric work (W)}}{\text{Time (t)}}$$

(2) Air pollution has major effects on human health. They can be short-term effects or long-term effects.

Short-term effects:

- Irritation of eyes, nose, mouth and throat
- Infections of the respiratory tract such as bronchitis and pneumonia
- Headache, nausea and allergy
- Asthmatic attacks
- Reduced lung functioning

Long-term effects:

- Chronic pulmonary disease
- Cardiovascular disease
- Lung cancer
- Premature death

(3) Given: Focal length $f = +2 \text{ D}$

$$\text{Power, } P = \frac{1}{f}$$

$$\therefore f = \frac{1}{P} = \frac{1}{2}$$

$$\therefore f = 0.5 \text{ m}$$

The power of the corrective lens is 0.5 m.

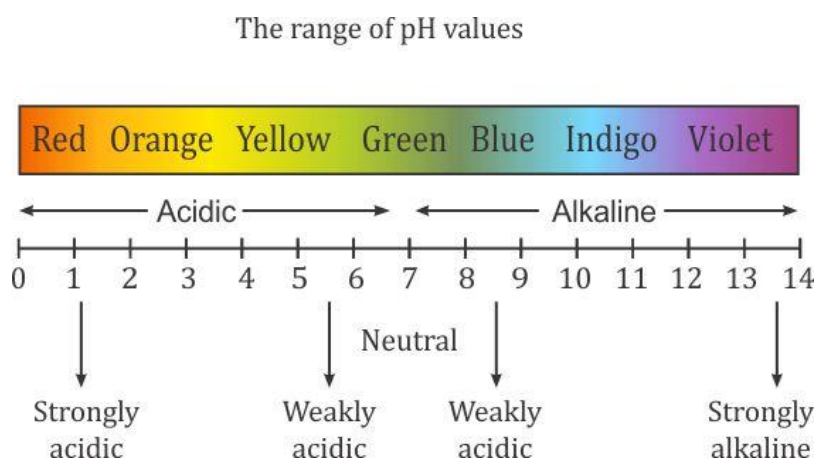
(4) Applications of sodium bicarbonate:

- (i) It is used to prepare light and spongy bread, cakes and *dhoklas*.
- (ii) Being alkaline, it helps reduce acidity in the stomach.
- (iii) It is very useful in preparing CO_2 gas, and it is one of the contents of fire extinguishers.

(Note: Write any two from the above points).

(5) When an object is placed within the focal length of a simple microscope, its magnified and erect image is obtained on the same side of the lens as that of the object. So, a watch repairer sees the minute parts of a watch very clearly with a simple microscope by adjusting the distance between the object and the lens. This helps in repairing the watch. Hence, a simple microscope is used by watch repairers.

(6) pH scale:



3.

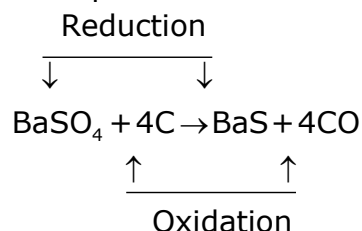
(1) Main features of Mendeleev's periodic table:

- (i) The horizontal rows in the periodic table are called periods. There are seven periods. These are numbered from 1 to 7.
- (ii) Properties of elements in a particular period show regular gradation from left to right.
- (iii) Vertical columns in the periodic table are called groups. There are eight groups numbered from I to VIII. Groups I to VII are further divided into A and B subgroups.

(2) Redox reaction:

When oxidation and reduction occur simultaneously in a given chemical reaction, it is known as a redox reaction.

Example of a redox reaction:



(3)

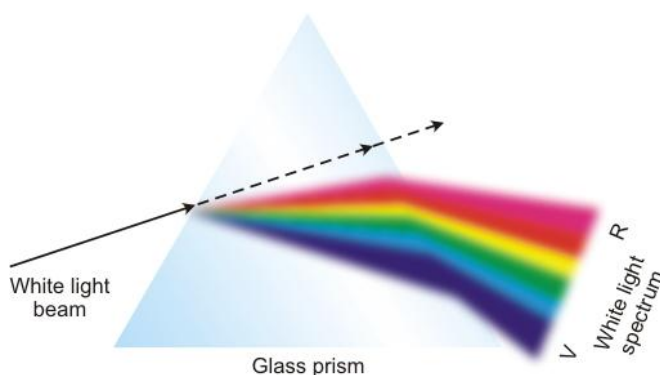
- (i) The defect shown in the figure is hypermetropia or long-sightedness.
- (ii) Two possible reasons are
 - a) Ciliary muscles have become weak, so the converging power of the eye lens decreases.
 - b) Because of shortening of the eye ball or flattening of the eye lens.
- (iii) To correct the eye defect, a suitable convex lens is used.

(4) The phenomenon of a change in the direction of the propagation of light when it passes obliquely from one transparent medium to another is called refraction of light.

For a given angle of incidence, the extent of refraction of light is different in different media.

- When the refractive index of the second medium is greater than the refractive index of the first medium, the refracted ray bends more towards the normal.
- When the refractive index of the first medium is greater than the refractive index of the second medium, the refracted ray bends away from the normal.

(5) When white light passes through a glass prism, it spreads out into a band of different colours called the spectrum of light.



- When white light is dispersed into seven colours by a glass prism, different colours bend through different angles with respect to the incident ray.
- The sequence of colours given by the prism is Violet, Indigo, Blue, Green, Yellow, Orange and Red.
- Of the seven colours, red light bends the least, while violet light bends the most. So, the rays of each colour emerge along different paths and appear distinct. Hence, we get a spectrum of seven different colours.

(6) Suggestive measures in the following situations:

(i) To avoid noise pollution in the classroom:

- When the teacher is not present in the classroom, all students should observe silence and not shout loudly.
- Activities such as book reading, solo singing or storytelling should be carried out so that the other students can maintain silence.
- The monitors in the class who control the classroom should ask the teacher to punish the students who make a lot of noise.
- Add curtains to the classroom.
- Use cork bulletin boards for the walls.
- Place sound-absorbent panels on the upper walls of the classroom.

(ii) The following practices should be adopted to minimise electricity consumption at home:

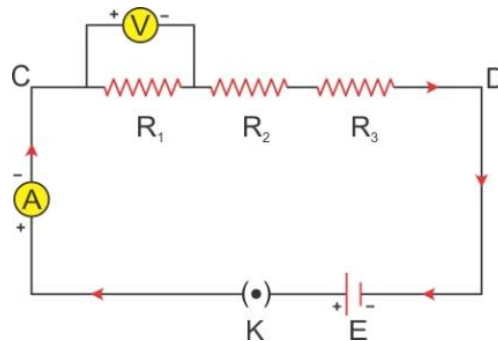
- Switch off the fans, lights and bulbs when not in use.
- Use of CFL should be encouraged.
- Avoid using air conditioners whenever possible.
- Allow sunlight and fresh air to enter the house to reduce the use of electricity during the day time.
- Use solar water heaters instead of electrical heaters.

(iii) The following steps should be adopted to minimise the bursting of fire crackers in festivals and processions:

- Bursting fire crackers should be strictly avoided because they cause noise and air pollution.
- If necessary, noiseless crackers or eco-friendly variety of crackers can be used.
- Fire crackers should not be burst near hospitals and other silence zones.
- Bursting of fire crackers should be banned after 10 p.m.

4.

(1) Expression for the resistors in series:



R_1 , R_2 and R_3 are the three resistors connected in series between points C and D as shown in the figure above. I is the current and V is the PD across points C and D.

R_s is the effective resistance in a circuit, and V_1 , V_2 and V_3 are the potentials across the three resistors such that

$$V = V_1 + V_2 + V_3 \quad \text{---- (1)}$$

Using Ohm's law, the total potential difference

$$V = I R_s$$

and $V_1 = IR_1$, $V_2 = IR_2$ and $V_3 = IR_3$

Substituting these values in Equation 1,

we get

$$IR_s = IR_1 + IR_2 + IR_3$$

$$\therefore R_s = R_1 + R_2 + R_3$$

For n number of resistors connected in series,

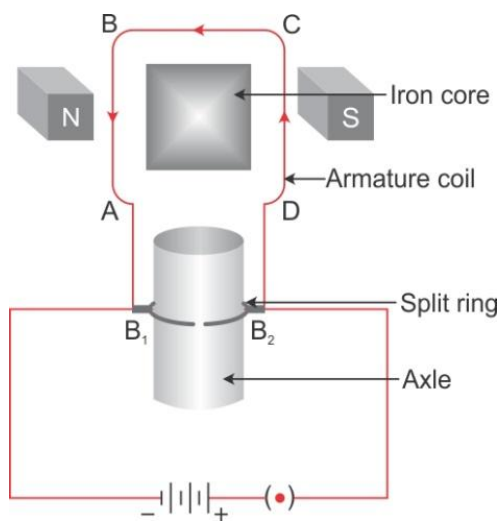
$$R_s = R_1 + R_2 + R_3 + R_4 + \text{-----} + R_n$$

Characteristics of a series combination of resistors:

- The same current flows through each resistor.
- The effective resistance of the combination is greater than any of the resistances in the combination.
- The effective resistance of the combination is equal to the sum of individual resistors.

(2)

(i) Electric motor:



(ii) Principle of Electric Motor:

An electric motor works on the principle that a current-carrying conductor placed in a magnetic field experiences a force.

(iii) Electric motors are used in domestic appliances such a mixer, blender and washing machine. DC motor is used in an electric fan, hair dryer, record player, tape recorder and blower.