CLASS X (2019-20)
SCIENCE (CODE 086)
SAMPLE PAPER-4

Time : 3 Hours **Maximum Marks : 80**

General Instructions :

(i) The question paper comprises of three sections-A, B and C. Attempt all the sections.
(ii) All questions are compulsory.
(iii) Internal choice is given in each sections.
(iv) All questions in Section A are one-mark questions comprising MCQ, VSA type and assertion-reason type questions. They are to be answered in one word or in one sentence.
(v) All questions in Section B are three-mark, short-answer type questions. These are to be answered in about 50-60 words each.
(vi) All questions in Section C are five-mark, long-answer type questions. These are to be answered in about 80-90 words each.
(vii) This question paper consists of a total of 30 questions.

Section A

1. How will the tendency to gain electrons change as we go from left to right across a period ? Why ? [1]

Ans :

On moving from left to right across a period, metallic character decreases and non-metallic character increases.

Since metals tend to lose electrons and non-metals tend to gain electrons, the tendency to gain electrons increases as we move from left to right across a period.

2. A shiny brown coloured element X' on heating in air becomes black in colour. Name the element X' and the black compound formed. [1]

Ans :

The shiny brown element is metal copper. The black compound formed is copper (II) oxide.

3. Answer question numbers 3.1-3.4 on the basis of your understanding of the following paragraph and the related studied concepts.

The arrangement of metals in a vertical column in the decreasing order of their re-activities is called the reactivity series or activity series of metals. The most reactive metal is at the top position of the reactivity series. The least reactive metal is at the bottom of the reactivity series.

Hydrogen, though a non-metal, has been included in the activity series of metals only for comparison. Apart from it, the hydrogen atom also has tendency to lose its valence electron and form cation like the behaviour shown by metals. Thus,

$$H \longrightarrow H^+ + e^-$$

3.1 Which metal can be displaced by copper from its salt solution? [1]

Ans : Copper can displace $AgNO_3$ because Copper is more reactive than silver.

3.2 An element 'X' after reacting with acids liberate hydrogen gas and can displace lead and tin from their salt solution. Write down the Name of X metal. [1]

Ans : Nickel

3.3 Write down the name of most reactive metal [1]

Ans : Potassium

3.4 Which metal does not liberate hydrogen gas after reacting with acid? [1]

Ans : Gold

4. Question number 4.1-4.4 are based on the two table below study these table related to equivalent resistance and answer the question that follows.

Table -A Combination of resistance

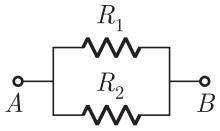
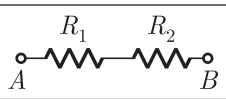
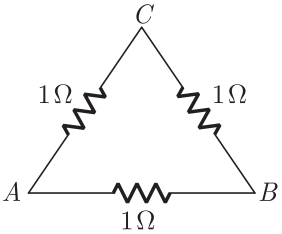
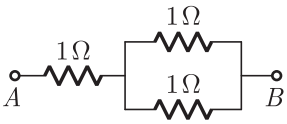
Combination	Circuit	Equivalent resistance
Parallel		$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$
Series		$R_{eq} = R_1 + R_2$

Table -B

Student	Circuit	Equivalent resistance
Student A	 Circuit - 1	1Ω
Student B	 Circuit - 2	1.5Ω

4.1 Which student measured the wrong equivalent resistance in Table-B? [1]

Ans : Student A

4.2 In which configuration of resistance, the potential difference across each resistance remains same? [1]

Ans : Parallel combination.

4.3 The value of equivalent resistance of circuit-1 is? [1]

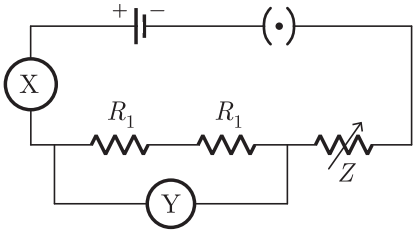
(a) 1Ω (b) 2Ω
(c) 0.4Ω (d) 0.6Ω

Ans : (d) 0.6Ω

4.4 In which configuration of resistance the current across each resistances remain same? [1]
(a) Series combination
(b) Parallel combination
(c) Mixed combination
(d) None of these

Ans : (a) Series combination

5. The given circuit diagram shows the experiment arrangement of different circuit components for determination of equivalent resistance of two resistors connected in series. The components X, Y and Z shown in the circuit respectively represent. [1]

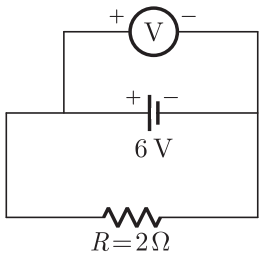


(a) Rheostat, Resistor Ammeter
(b) Voltmeter, Ammeter, Rheostat
(c) Ammeter Voltmeter, Rheostat
(d) Rheostat, Ammeter, Voltmeter

Ans : (c) Ammeter, Voltmeter, Rheostat

or

When a student connects a voltmeter across the terminals of a battery, it measures 6 V. If he connects a resistance of $2\,\Omega$ across the terminals of the battery as shown in the figure, then the current flowing through this resistance (R) must be



(a) 2 A (b) 3 A
(c) 4 A (d) 6 A

Ans : (b) 3 A

6. A student was asked to obtain real image of a tree on the screen with the help of suitable mirror. He can do by taking a : [1]
(a) concave mirror
(b) plane mirror
(c) convex mirror
(d) both either concave or by convex mirror

Ans : (a) concave mirror

7. A student wants to draw diagram for formation of a real image at 2F of a convex lens. For this he must take the object placed at [1]
(a) infinity
(b) focus
(c) between optical centre and focus
(d) 2 F

Ans : (d) 2 F

8. In the experimental set-up to show that CO_2 is given out during respiration, the level of water in the delivery tube (the end that is immersed in water of the beaker) shows a: [1]
(a) gradual fall (b) rapid fall
(c) rise and fall alternately (d) rise

Ans : (d) rise

or

In binary fission, the parent cell divides by the process
(a) the cytoplasm and nucleus divide at same time
(b) the nucleus first divides then cytoplasm
(c) the cytoplasm first divides then nucleus
(d) the cytoplasm and nucleus do not divide

Ans : (b) the nucleus first divides then cytoplasm

9. $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$
The above reaction is an example of a : [1]
(a) combination reaction
(b) double displacement reaction
(c) decomposition reaction
(d) displacement reaction

Ans : (d) displacement reaction

10. The colours obtained on a pH paper for a highly acidic, basic and neutral solutions are [1]
(a) blue, orange, green (b) yellow, blue, green
(c) red, blue, green (d) red, green, blue

Ans : (c) red, blue, green

11. When a student boiled the given sample of water containing temporary hardness, he observed that it now gave good amount of lather because by boiling : [1]
(a) the bicarbonate of sodium decomposes
(b) the bicarbonate of magnesium decomposes
(c) the bicarbonate of Zn decomposes
(d) the bicarbonate of Al decomposes

Ans : (b) the bicarbonate of magnesium decomposes

12. Which of the following is not a property of carbon? [1]
(a) Carbon compounds are good conductor of heat and electricity
(b) Carbon compounds are poor conductor of heat and electricity

(c) Most of the carbon compounds are covalent compounds

(d) Boiling and melting point of carbon compounds are relatively lower than those of ionic compounds

Ans : (a) Carbon compounds are good conductor of heat and electricity

or

Which of the following is not the use of graphite?

(a) It is used as lubricant

(b) It is used in manufacturing of lead-pencils

(c) It is used in manufacturing of artificial diamond

(d) It is used for making insulated plates

Ans : (d) It is used for making insulated plates

Graphite can not be used for making insulated plates, as it is a good conductor of electricity.

For question numbers 13 and 14, two statements are given-one labeled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Assertion is true and reason is correct explanation of assertion.

(b) Assertion is true but reason is false.

(c) Assertion is false but reason is true.

(d) Both are true but reason is not correct explanation of assertion.

13. **Assertion** : Copper reacts with silver nitrate solution.
Reason : Copper is placed higher in the metal activity series than silver. Thus, it can displace silver from silver nitrate solution [1]

Ans : (a) Assertion is true and reason is correct explanation of assertion.

14. **Assertion** : Mendeleev did not leave any gap in his periodic table.
Reason : Gaps were necessary for unknown elements. [1]

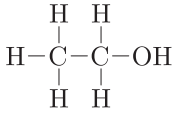
Ans : (c) Assertion is false but reason is true.

Section B

15. An organic compound 'A' is an essential constituent of wine and beer. Oxidation of 'A' yields an organic acid 'B' which is present in vinegar. Name the compounds 'A' and 'B' and write their structural formula. What happens when 'A' and 'B' react in the presence of an acid catalyst? Write the chemical equation for the reaction. [3]

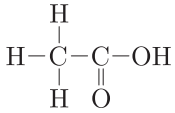
Ans :

Ethyl alcohol is an essential constituent of wine and beer. Therefore, A is ethyl alcohol. Oxidation of ethyl alcohol gives acetic acid. Vinegar contains acetic acid. Therefore, B is acetic acid.



Ethyl alcohol

(A)



Acetic acid

(B)

When A and B react in the presence of an acid catalyst, the ester, ethyl acetate is formed.

$$\underset{\text{ethyl alcohol}}{CH_3CH_2OH} + \underset{\text{acetic acid}}{CH_3COOH} \xrightarrow[H_2SO_4]{\text{conc.}} \underset{\text{ethyl acetate}}{CH_3COOC_2H_5} + H_2O$$

16. Give two uses each of the products obtained by the electrolysis of sodium chloride. [3]

Ans :

Hydrogen : It is used for cutting and welding purpose in the oxy-hydrogen flame.

Chlorine :

i. It is used for the sterilisation of drinking water.

ii. It is used in the preparation of pesticides and insecticides.

Sodium hydroxide :

i. It is used in the manufacture of soap and detergents.

ii. It is used in making paper pulp in the paper industry.

or

Name the type of chemical reaction presented by the following equations:

i. $CaCO_3(s) \xrightarrow{\text{heat}} CaO(s) + CO_2(g)$

ii. $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq)$

iii. $Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g)$

Ans :

i. Chemical decomposition reactions.

ii. Chemical combination reaction.

iii. Chemical displacement reaction.

17. (a) Name metals among the first five elements of the Modern Periodic Table.

(b) Write their symbols.

(c) Write the formula of their oxides.

Ans :

a. Lithium and Beryllium are metals among first five elements.

b. Lithium (Li), Beryllium (Be).

c. Li_2O and BeO are the formulae of their oxides.

18. List and describe in brief any three ways devised to avoid pregnancy. [3]

Ans :

i. Foam tablets, jellies, creams and spermicide's are common chemicals used by females. These are placed in vagina.

ii. Ovulation and fertilisation can be prevented by changing hormonal balance of the body. It can be done by taking oral pills.

iii. Intrauterine Contraceptive Device (IUCD) such as the loop or the copper-T are placed in the uterus to prevent pregnancy. The drawbacks with these devices are bleeding and discomfort.

or

What are sexually transmitted diseases? Name four such diseases. Which one of them damages the immune system of human body?

Ans :

The diseases which are spread by sexual contact from an infected person to a healthy person, are called sexually transmitted diseases or STDs.

i. AIDS (Acquired Immuno Deficiency Syndrome)
ii. Gonorrhoea
iii. Syphilis
iv. Genital herpes

'AIDS' – damages the immune system of human body.

19. What is biodegradable substances? Describe two ways in which non-biodegradable substances affect our environment. [3]

Ans :

Biodegradable substances : The substances which can be degrade or decomposed by the bacteria and fungi are called biodegradable substances.

Non-biodegradable substances : The substances which cannot be decomposed by bacteria and fungi are called non-biodegradable substances.

The non-biodegradable substances affect our environment as :

i. Non-biodegradable substances chock the sewage system and pollute the soil.
ii. Some of the non-biodegradable substances may toxic for the humans and produce various diseases.

20. Define 'nerve impulse'. Which structure in a neuron helps to conduct a nerve impulse : [3]

i. towards the cell body ?
ii. away from the cell body?

Ans :

The information passing through the neurons in the form of chemical and electrical signals is called nerve impulse.

i. Dendrites –Towards the cell body.
ii. Axon –Away from the cell body.

21. How do auxins promote the growth of a tendril around a support? [3]

Ans :

Auxins stimulate cell elongation and growth. It is observed that the shoot tips bend towards a unilateral source of light. The hormone synthesised at the shoot tips helps in the bending of shoots towards the light source. When light falls on one side of the plant, auxin diffuses towards the shady or dark side of the shoot. More concentration of auxin on the dark side stimulates more cell elongation on this side than the lighted side. As a result, the dark side grows more and the shoot bends towards light.

22. i. What is meant by scattering of light?
ii. Mention the factor on which it depends. Explain why the colour of the clear sky is blue?
iii. An Astronaut in space finds sky to be dark. Explain reason for this observation. [3]

Ans :

i. Scattering of light is the phenomenon due to which light gets deflected by the atoms, molecules or particles of the medium when light falls on them. These are known as scatterer particles.
ii. Factors on which scattering depends are the size of the atoms, molecules of the scatterer.
When sunlight falls on the atoms or molecules of the gases shorter wavelengths like of blue colour get scattered more due to which sky appears blue.
iii. In space there is no atmosphere, so there is no scattering hence the sky appears dark/black.

23. How does a solenoid behave like a magnet ? Can you determine the north and south poles of a current-carrying solenoid with the help of a bar magnet? Explain. [3]

Ans :

When the current flows through a solenoid, each turn of it sets up a magnetic field which is at right angles to the plane of the coil. Thus, each turn in its own right behaves like a magnet, such that its one face is north pole, and the other face is south pole. As these tiny magnets in the form of turns are arranged along the same axis, therefore, the solenoid on the whole behaves like a magnet.

In order to find the polarity of the solenoid, suspend it freely so that it is pointing in the north-south direction. Now, bring the north pole of a permanent bar magnet near one end of the solenoid. If this end gets repelled then this is the north pole of the solenoid.

24. A 5.0 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 30 cm. By calculation determine (i) the position and (ii) the size of the image formed. [3]

Ans :

Given, height of object, $h_o = 5$ cm

Focal length of lens, $f = 20$ cm

Image of distance, $u = -30$ cm

(i) Applying, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

Focal length $\frac{1}{v} = \frac{1}{20} + \frac{1}{-30}$

$\frac{1}{v} = \frac{3-2}{60} = \frac{1}{60}$ or $v = 60$ cm

(ii) Applying, $\frac{h_i}{h_o} = \frac{v}{u} \Rightarrow \frac{h_i}{5} = \frac{60}{-30}$

$h_i = \frac{-60 \times 5}{30} = -10$ cm

or

A real image, $\frac{1}{5}^{\text{th}}$ the size of object is formed at a distance of 18 cm from a mirror. What is the nature of mirror? Calculate its focal length.

Ans :

As we know that,

Imagination, $m = -\frac{v}{u} \Rightarrow -\frac{1}{5} = \frac{-18}{u}$

$u = -5 \times 18 = -90$ cm

$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = -\frac{1}{90} + \frac{1}{-18}$

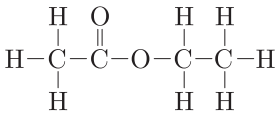
$= \frac{-1-5}{90} = -\frac{6}{90} = -\frac{1}{15}$

$f = -15$ cm

Thus, real, inverted and smaller image is formed in the concave mirror.

Section C

25. i. The structural formula of an ester is :



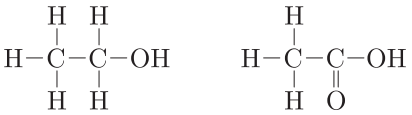
Write the structural formulae of the corresponding alcohol and the acid.

ii.
(a) Mention the experimental conditions involved in obtaining ethene from ethanol.
(b) Write the chemical equation for the above reaction.

iii. Explain the cleansing action of soap. [5]

Ans :

i.



Ethyl alcohol Acetic acid

ii.
(a) When ethanol is heated with excess of concentrated sulphuric acid at 443 K, it gets dehydrated to form ethene.

(b) $C_2H_5OH + \underset{\text{Conc.}}{H_2SO_4} \xrightarrow{443\ K} \underset{\text{ethene}}{H_2C = CH_2} + H_2O$

iii. A molecule of soap is made up of two parts:
(a) An ionic part which is hydrophilic, i.e, water soluble.
(b) A hydrocarbon chain which is hydrophobic i.e., water-repelling and oil soluble.

Soap molecule

When soap is at the surface of water, the hydrophobic tail protrudes out of water while the ionic end remains inside water. Inside water, the molecules form clusters with the hydrophobic tails in the interior of the cluster and the ionic ends on the surface of the cluster. This formation is called a micelle. Soap, in the form of micelle collects the oily dirt in the centre of the micelle. The micelles stay in solution as a colloid and do not precipitate due to ion-ion repulsion. Thus, the dirt suspended in water is washed away during rinsing.

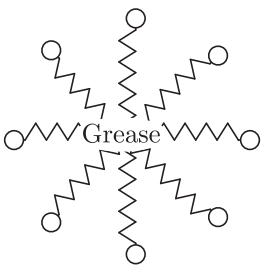


Figure: A micelle entrapping grease particle

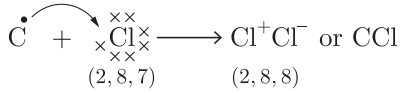
or

Atoms of seven elements A, B, C, D, E, F and G have a different number of electronic shells but have the same number of electrons in their outermost shells. The elements A and C combine with chlorine to form an acdi and common salt respectively. The oxide of element A is a liquid at room temperature and is a neutral substance, while the oxides of the remaining six elements are basic in nature. Based on the above information answer the following questions.

i. What could the element A be ?
ii. Will elements A to G belong to the same period or same group of the periodic table ?
iii. Write the formula of the compound formed by the reaction of element A with oxygen.
iv. Show the formation of the compound by a combination of element C with chlorine with the help of an electronic structure.
v. Which one of the given elements is likely to have the smallest atomic radius ? [5]

Ans :

i. Hydrogen
ii. Elements A to G belong to the same group of the periodic table since they contain the same number of electrons in their outermost shells.
iii. $2H_2^+ + O_2 \longrightarrow 2H_2O$ (Since A is hydrogen)
iv.



v Hydrogen (represented by A) is likely to have the smallest atomic radius amongst all the elements in a group. This is because the atomic radius increases while moving down the group.

26. Give reasons for the following : [5]
i. Zinc oxide is considered as an amphoteric oxide.
ii. Non-metals in general do not displace hydrogen from dilute acids.
iii. Metals conduct electricity.

Ans :

i. Zinc oxide reacts with acids as well as caustic alkalis to form salt and water as the only products and hence, it is called an amphoteric oxide.
ii. It is because the ionisation potential of most of the non-metals is lower than hydrogen. Thus, non-metals cannot displace hydrogen from dilute acids.
iii. Metals have one to three electrons in their valence shell and these are very loosely held by the nucleus. Thus, when an electric potential is applied at the ends of a metal object, these free electrons start drifting in some particular direction, thereby making the metals good conductors of electricity.

27. Make a comparison between photosynthesis and respiration. [5]

Ans :

The comparison between photosynthesis and respiration are following :

	Photosynthesis	Respiration
1.	It takes place only in the presence of light.	It occurs in all the tissues during both day and night.
2.	Only green cells of plants can perform photosynthesis.	This occurs in all the cells of an organism.
3.	It takes place inside chloroplast.	Aerobic respiration involves mitochondria and cytoplasm.
4.	It is an anabolic process in which complex compounds (sugars) are broken down into simpler (CO_2 and H_2O) compounds.	It is a catabolic process in which complex compounds (sugars) are formed from the inorganic substances (CO_2 and H_2O).

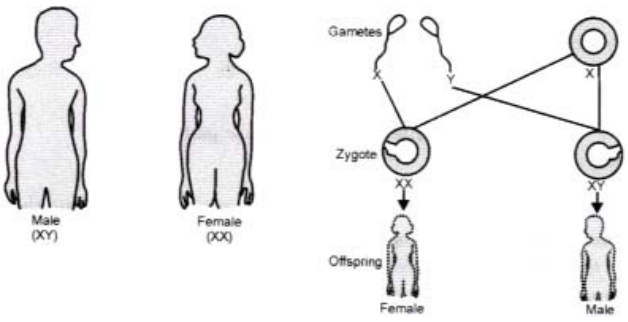
28. i. What are chromosomes ? Where are they seated ?
ii. What is a sex chromosome ?
iii. Explain the mechanism of sex determination in human beings. [5]

Ans :

i. **Chromosomes :** Chromosomes are the thread like structures found in the nucleus of a cell (plant and animal). These are composed of chromatin and carry the genes from one generation to the next generation.

ii. A chromosome that helps in determining the sex of an individual is known as a sex chromosome.

iii. **The mechanism of sex determination in human beings :** It is assumed that half the children of a couple will be girls and half will be boys. All children of the couple will inherit similar chromosomes (22 + X) from the mother but the sex of the children will depend on the chromosome they inherit from the father. If a child inherits 22 + X chromosomes from the father that will be a girl but when a child will inherit 22 + Y chromosomes from the father that will be a boy. Therefore, the sex of a child is determined by the inheritance of X or Y chromosome from the father.



or

What is lymph? Write its important functions.

Ans :

The light yellow fluid in the lymphatic vessels is called lymph. It flows only in one direction from tissues to heart.

Functions of lymph :

i. Lymph functions as a middleman that exchanges materials between blood and tissue fluid.
ii. Lymph helps in maintenance of blood volume.
iii. Lymphocytes mature inside the lymph nodes and are released into lymph passing through the same.
iv. Lymph picks up digested fat from alimentary canal for pouring into blood.
v. Lymph capillaries are specialised to attract and localise germs.
vi. Tissue secretions i.e., hormones, macromolecules, plasma proteins are first poured into lymph for passage into blood.

29. i. Define 1 dioptre of power. Find the focal length of a lens of power $-2.0\,\text{D}$. [5]
ii. Why does a lemon kept in a glass tumbler appear to be bigger than its actual size ?
iii. Study the table given below and state the medium in which light ray will travel fastest. Why ?

Medium	*A*	*B*	*C*
Refractive Index	1.33	1.5	2.4

iv. What do you mean by dispersion of light?

Ans :

i. One dioptre is the power of a lens of focal length 1 m.

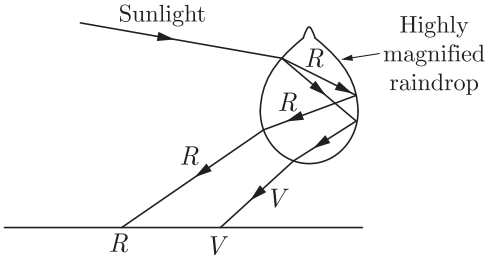
$$\text{Focal length, } f = \frac{1}{P} = \frac{1}{-2.0}$$

$$= -0.5\,\text{m} = -50\,\text{cm}$$

ii. It is because of refraction from denser medium to rarer medium.

iii. Light ray will travel fastest in medium A due to its least refractive index.

iv. **Dispersion of light :** The phenomenon due to which a white light splits into its component colours, when passed through a prism.
White light is combination of seven different colours of light having different wavelengths. More is the wavelength of light, less is the angle of deviation for the same material and same angle of incidence. This is caused of dispersion of white light.



30. i. Two identical resistors each of resistance $10\,\Omega$ are connected in :
(a) Series (b) Parallel
in turn to a battery of 6 V. Calculate the ratio of power consumed by the combination of resistor in the two cases
ii. List two factors on which the resistance of a conductor depends.
iii. Write a difference between an ammeter and voltmeter. [5]

Ans :

i. (a) When resistors are connected in series.

Then, equivalent resistance, $R_S = 10\,\Omega + 10\,\Omega$

$= 20\,\Omega$

Now, Power consumed,

$$P_S = \frac{V^2}{R_S} = \frac{6 \times 6}{20} = 1.8\,\text{W}$$

(b) When resistors are connected in parallel than equivalent resistance, $\frac{1}{R_P} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10} = \frac{1}{5}$

$$R_P = 5\,\Omega$$

Thus, power consumed,

$$P_P = \frac{V^2}{R_P} = \frac{6 \times 6}{5} = 7.2\,\text{W}$$

Then, $\frac{P_S}{P_P} = \frac{1.8\,\text{W}}{7.2\,\text{W}} = \frac{1}{4}$

$$P_S : P_P = 1:4$$

ii. Resistance of a conductor depends on:
(a) length of the conductor
(b) area of cross-section of conductor.

iii.

	Ammeter	Voltmeter
1.	It is used to measure the current in a circuit.	It is used to measure the potential difference in a circuit.
2.	It is always connected in series in the circuit	It is always connected in parallel in the circuit.

or

i. State the commercial unit of electric energy and find its relation with its SI unit.
ii. The current through a resistor is made three times its initial value. Calculate how it will affect the heat produced in the resistor.
iii. Find the amount of heat generated in a conductor if another conductor of double resistance is connected in the circuit keeping all other factors unchanged.

Ans :

i. Commercial unit of electric energy = kWh

$$1\ \text{kWh} = 3.6 \times 10^6\,\text{J}$$

ii. Initial heat generated in the resistor,

$$H_1 = I^2Rt \qquad ...(1)$$

when current is made three times i.e. $3I$ now heat generated

$$H_2 = (3I)^2Rt \qquad ...(2)$$

$$H_2 = 9I^2Rt$$

from equation (1), we get

$$H_2 = 9H_1$$

In later case, heat generated is 9 times the initial heat generated.

iii. If another conductor of $2R$ is connected in series then total resistance $= R + 2R = 3R$.

Now heat generated $H = I^2(3R)t$

$$H = 3I^2Rt$$