Maharashtra State Board
Class X Science and Technology
Board Paper – 2015 Solution

SECTION A

1.

(A)

(a)

(i) The device used for producing electric current is called a **generator.**

(ii) **Stratosphere**, the second layer of the atmosphere, reaches 48 km above the Earth's surface.

(b)

Column A	Answers
(i) eosin	(2) synthetic indicator
(ii) oxidation	(1) losing hydrogen

(c) The molecular formula of bleaching powder: $CaOCl_2$

(B)

(1) **(a)** colourless

When phenolphthalein is added to NaOH, the colour of the solution will become colourless.

(2) **(d)** 5 A

V = IR

$\therefore 220\ V = I \times 44\ \Omega$

Or, $I = \frac{220\ V}{44\ \Omega} = 5\ A$

(3) **(b)** 10^3 mA

1 ampere = 1000 mA = 10^3 mA

(4) **(b)** Focal length

The distance between the principal focus and the optical centre of the lens is its focal length.

(5) **(b)** Parallel

When rays of light are incident on a glass slab, the incident and the emergent rays are parallel to each other. However, the emergent ray is displaced from the actual line of the incident ray. This is called lateral shift.

2.

(1) The effectiveness with which small particles scatter light depends on the size of the particles and the wavelength of the incident light. Red light has the longest wavelength and hence is scattered least by fog or smoke. Hence, red light can be clearly seen even from a distance. So, danger signal lights are usually red in colour.

(2) $CuO + 2HCl \rightarrow \underline{CuCl_2} + \underline{H_2O}$

The name of the products are copper(II) chloride ($CuCl_2$) (also known as cupric chloride or copper chloride) and water (H_2O).

(3) 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.

(4) Given that

$\upsilon_1 = 3 \times 10^8$ m/s ; $\upsilon_2 = 1.5 \times 10^8$ m/s

We know that, the refractive index with respect to air is

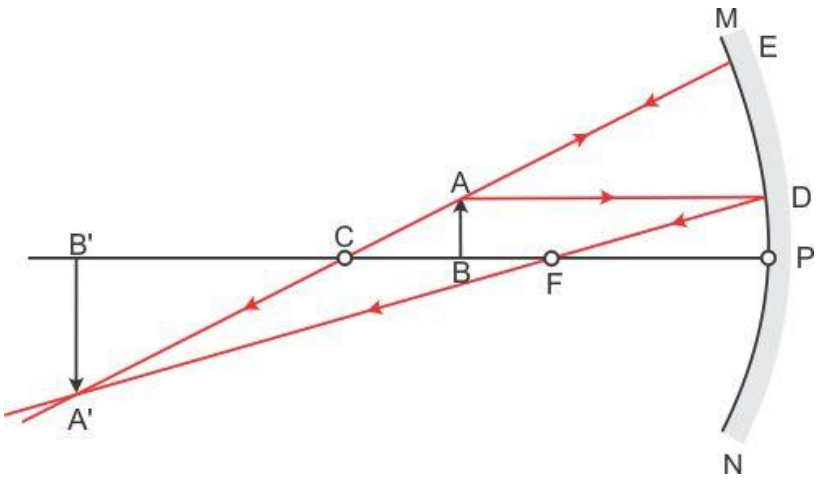
$$_1\eta_2 = \frac{\upsilon_1}{\upsilon_2} = \frac{3\times10^8}{1.5\times10^8} = 2$$

Thus, the refractive index of the medium with respect to air is 2.

(5)

Resistances in Series	**Resistances in Parallel**
1. In this type of connection, the resistances are connected one after the other such that the same amount of current flows through each resistance.	1. In this type of connection, the resistances are connected between two common points such that the potential difference across each resistor is the same.
2. For n number of resistors connected in series, the effective resistance R_S is equal to the sum of the individual resistors. $R_S = R_1 + R_2 + R_3 + R_4 + \ldots\ldots R_n$	2. For n number of resistors connected in parallel, the reciprocal of the effective resistance (R_p) is equal to the sum of the reciprocals of the individual resistances. $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots\ldots\ldots\ldots\ldots + \frac{1}{R_p}$
3. The effective resistance in series combination is greater than the individual resistances.	3. The effective resistance in parallel combination is less than the individual resistances in the combination.
4. It is used to decrease the current in the circuit.	4. It is used to increase the current in the circuit.

(6) When the object is between the centre of curvature and the focus of a concave mirror:



3.

(1) **<u>Role of citizens in pollution control</u>**:

- Plant trees and develop gardens, parks and open grounds in nearby localities
- Save fossil fuels and reduce pollution
- Minimise the consumption of electricity
- Use public transport instead of private vehicles
- Use non-conventional sources of energy such as solar, wind and tidal energy
- Maintain vehicles in proper condition
- Keep your home and public places clean and free from pollution

(2) The band of coloured components of a beam of light is called a spectrum. The refractive index of the material of the prism is different for different colours. White light is composed of seven colours. When white light is incident on a prism, the constituent colours get refracted through different angles and get dispersed. So, the rays of each colour emerge along different paths and become distinct. Hence, we get a spectrum of seven different colours.

(3) The four most common appliances based on the heating effect of electrical current are electric iron, electric heater, electric oven and electric toaster. Finely heated platinum wire is used in surgery for cutting tissues much more efficiently than a knife.

(4) The chemical formula of Plaster of Paris (POP) is $CaSO_4.½\ H_2O$. Gypsum ($CaSO_4.2H_2O$) is formed on mixing POP with water as follows: $CaSO_4.½\ H_2O + 1½\ H_2O \rightarrow CaSO_4.2H_2O$

Uses of POP:

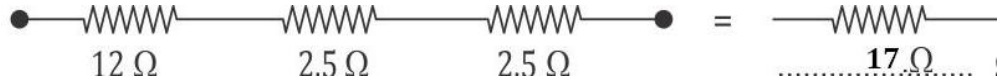
- In hospitals, as plaster for supporting fractured bones in the right position.
- For making decorative materials and for making wall surfaces smooth.
- As a fire-proofing material.

(5)

Metals	Non-metals	Metalloids
Mg	C	Si
Hg	S	As

(6)

(a)

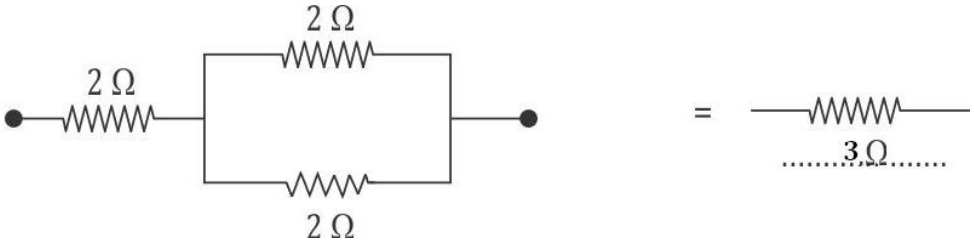


The equivalent resistance is $R_s = 12\ \Omega + 2.5\ \Omega + 2.5\ \Omega = 17\ \Omega$

(b)

The equivalent resistance is $R_p = \frac{1}{4} + \frac{1}{4} = \frac{1+1}{4} = \frac{1}{2}\ \Omega$

(c)



The equivalent resistance is $R_{eq} = 2 + \left(\frac{1}{2} + \frac{1}{2}\right) = 2 + \frac{2}{2} = 2 + 1 = 3\ \Omega$

4.

(A)

(1) When the live wire and the neutral wire come in direct contact, short circuiting takes place.

(2) The resistance of the circuit decreases during a short circuit.

(3) The flow of current abruptly increases during a short circuit.

(4) When the current in the circuit exceeds, the load exceeds the specified limit and overloading occurs.

(5) The effects of overloading can be avoided by connecting a fuse in series with the circuit.

(B)

(1) The negative power indicates that the spectacles used by the students have concave lens.

(2) The positive power indicates that the spectacles used by the students have convex lens.

(3) Diverging or concave lens spectacles are generally used by the students.

(4) Most of the students suffer from the eye defect known as myopia (near sightedness).

(5) The two possible reasons for the eye defect (myopia) are

- Converging power of the eye lens becomes high as ciliary muscles do not relax sufficiently.
- Length of the eye ball increases as the distance between the eye lens and the retina increases.

SECTION B

5.

(A)

(a)

(1) Tinning : Tin : : Galvanizing : **Zinc**

(2) Mammals : **Reptiles** : : Amphibia : Fishes

(b)

(1) True

(2) False

In human beings, the blood goes to the heart twice in one cycle. This is called double circulation.

(3) True

(B)

(1) **(a)**

The molecular formula of acetic acid is **CH_3COOH.**

(2) **(c)**

Carbon dioxide enters the leaves through tiny pores present on the surface of the leaf called **stomata**.

(3) **(a)**

$CuSO_4$ solution is blue in colour.

(4) **(d)**

Yeast reproduces by **budding**.

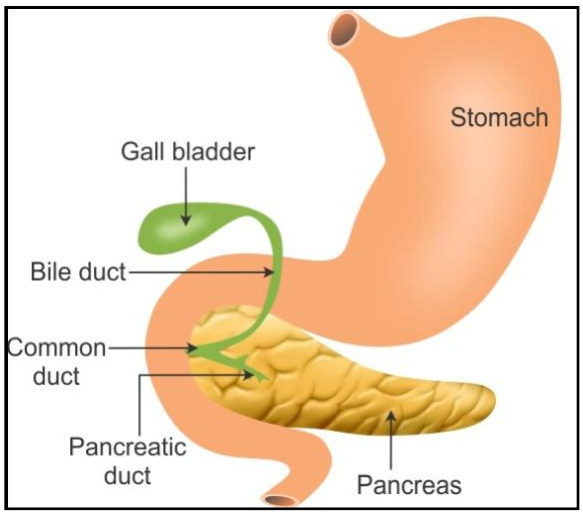
(5) **(b)**

Raisins put in water absorbs water by the process of **osmosis**.

6.

(1) Common salt has high melting and boiling points because there is a strong force of attraction between the oppositely charged ions, and a large amount of energy is required to break the strong bonding force between these ions.

(2) Pancreas with its associated structures:



(3) Connecting links between Peripatus and Annelida:

- Segmental nephridia
- Thin cuticle
- Parapodia-like appendages

Connecting links between Peripatus and Arthropoda:

- Trachea
- Open circulation

(4) Two plant hormones: Gibberellins, cytokinins
Function of gibberellins: Help in the growth of the stem
Function of cytokinins: Promotes cell division

(5)

Toilet Soap	Laundry Soap
• It has high-quality fats and oils as raw materials.	• It has low-quality fats and oils as raw materials.
• Expensive perfumes are added to these soaps.	• Cheap perfumes are added to these soaps.
• To avoid skin injuries, special care is taken to ensure that there is no free alkali.	• No such care is taken.
• Fillers are absent.	• Fillers are present.

(6) Objectives of sustainable development are

- Reduce pollution by using eco-friendly techniques
- Restrain the use of natural resources to ensure their availability for future generations
- Protection of the environment
- Promote continuous economic growth

7.

(1) An alloy is a homogeneous mixture of two or more metals or of one or more metals with certain non-metallic elements.

Name	Composition	Uses
Brass	Cu = 60–80% Zn = 40–20%	For making utensils, cartridges
Bronze	Zn = 2%, Cu = 80% Sn = 18%	For making utensils, statues and coins

(2)

(a) Neuroglia
(b) Synapse
(c) Forebrain (Cerebrum)

(3) Fertilisation:

- Fertilisation takes place when the sperm unites with the egg.
- The sperms enter through the vaginal passage and travel upwards and reach the oviduct.
- In the oviduct, one of the sperms fuses with the egg and the fertilisation is completed.

Development:

- Fertilisation results in the formation of zygote.
- The zygote divides and redivides to form a ball of cells called blastocyst.
- The blastocyst gets implanted on the wall of the uterus and forms the embryo.
- The embryo obtains all the nourishment and oxygen from the mother's blood.
- A structure called placenta present in the uterus supplies all the necessary nutrients to the embryo through the umbilical cord.
- The development of the foetus takes place for nine months.

Birth:

- When the baby is grown completely, it begins to move down towards the vaginal passage.
- The opening of the cervix gradually opens, and the baby is released out through the vagina.

(4) Vestigial organs:

Vestigial organs are the organs which are non-functional in some organisms but may have essential functions in other organisms.

Examples of vestigial organs in human beings: Vermiform appendix, plica semilunaris

Examples of vestigial organs in plants: Scale leaves in Indian pipe plant, stamens which lack anthers in some plants

(5) Recycling of waste:

It is a type of green technology which utilises old materials to make new products.

Example: Used paper is recycled to produce computer printing paper, paper plates, toilet paper, paper towels etc.

Advantages of recycling:

- It conserves energy and raw materials.
- It reduces the cost of production.

(6) Sexual reproduction gives rise to variation.

Importance of variation in survival of species:

- Variations result in variety and diversity.
- Due to adaptive variations, organisms are able to survive in changed environmental conditions.
- It prevents complete extinction of any species.
- Evolution continues through these variations and adaptations.

8.

(A)

(1) Anaerobic reaction = CO_2 + Ethanol

(2) Reaction in human muscles = Lactic acid

(3) Aerobic respiration = $CO_2 + H_2O$

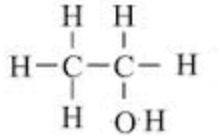
(4) Respiration in plant cells = Starch

(5) Reaction in liver = Glycogen

(B)

(1) Ethyl alcohol and grain alcohol are the other two names of ethanol.

(2)



Ethyl alcohol

(3) Two properties of ethanol:

(i) It is an inflammable volatile liquid.

(ii) It is soluble in water as well as in organic solvents.

(4) Ethanol reacts with phosphorus trichloride at room temperature to give chloroalkane and phosphorus acid.

$3C_2H_5OH + PCl_3 \rightarrow 3C_2H_5Cl + H_3PO_3$