Maharashtra State Board
Class X Science and Technology – Paper 1
Board Paper 2019

Time: 2 Hours **Maximum Marks: 40**

Note:

(i) All questions are compulsory.
(ii) Draw scientifically, technically correct labelled diagrams wherever necessary.
(iii) Start writing each main question on a new page.
(iv) Figures to the right indicate full marks.
(v) For each MCQ (i.e. Q. No. 1-B) evaluation would be done for first attempt only.
(vi) For each MCQ, correct answer must be written along with its alphabet.
E.g. : (i) (a) ……., (ii) (b) ……., (iii) (c) …….

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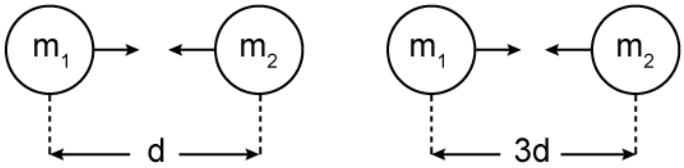
1. (A) Answer the following questions: **5**

(1) Write proper answer in the box:



If $F = \frac{Gm_1m_2}{d^2}$, then $F =$ ☐

(2) In the Dobereiner's triad Li, Na, K, the atomic masses of Lithium and Potassium are 6.9 and 39.1, respectively, then what will be the atomic mass of sodium.

(3) State whether the given statement is true *or* false:
A concave lens is a converging lens.

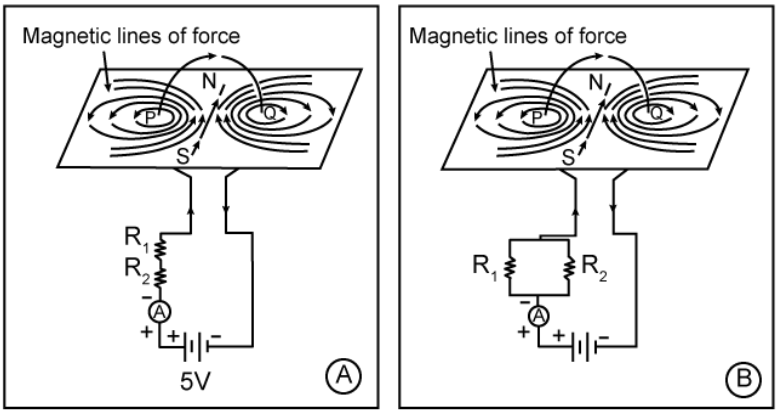
(4) By considering first correlation, complete the second correlation:
Hubble telescope: 569 km high from earth surface
Revolving orbit of Hubble telescope: ☐

(5) Find the odd man out:
Tinning, Anodization, Alloying, Froth flotation

(B) Choose the *correct* alternative: **5**

(1) The reaction of iron nail with copper sulphate solution is …….reaction.
(A) Combination
(B) Decomposition
(C) Displacement
(D) Double displacement

(2) Observe the following diagram and choose the correct alternative:



(a) The intensity of magnetic field in A is larger than in B.
(b) The intensity of magnetic field in B is less than in A.
(c) The intensity of magnetic field in A and B is same.
(d) The intensity of magnetic field in A is less than in B.

(3) A ray of light makes an angle of 50° with the surface S_1 of the glass slab. Its angle of incidence will be ……..
(a) 50°
(b) 40°
(c) 140°
(d) 0°

(4) Water expands on reducing its temperature below ……..°C.
(a) 0
(b) 4
(c) 8
(d) 12

(5) The carbon compound used in daily life is …….
(a) Edible oil
(b) Salt
(c) Carbon dioxide
(d) Baking soda

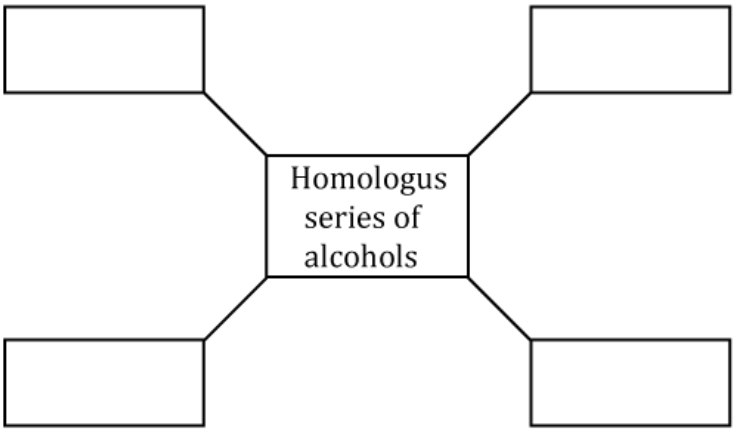
2. Attempt any *five* of the following questions: 10

(1) Two tungsten bulbs of power 50 W and 60 W work on 220 V potential difference. If they are connected in parallel, how much current will flow in the main conductor?

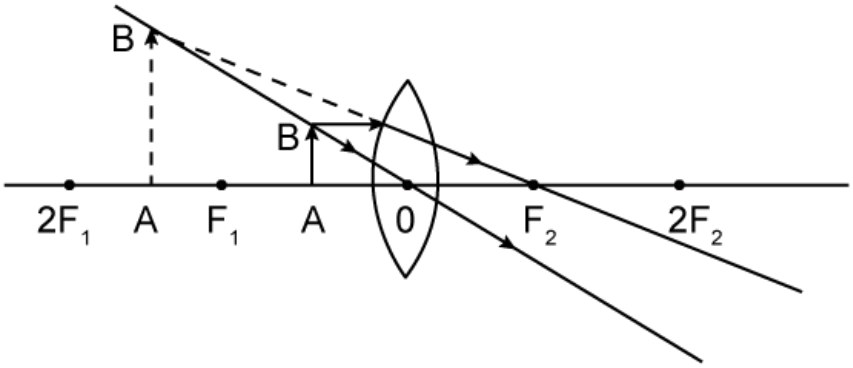
(2) Give scientific reason:
In the electric equipment producing heat, e.g. iron, electric heater, boiler, toaster etc., an alloy such as Nichrome is used, not pure metals.

(3) A metal ball of mass 5 kg falls from a height of 490 m. How much time will it take to reach the ground? ($g = 9.8\ m/s^2$)

(4) Write the names of first four homologous series of alcohols:



(5) Observe the following figure and complete the table:



Points	Answers
(i) Position of the object (ii) Position of the image (iii) Size of the image (iv) Nature of the image	

(6) Out of sodium and sulphur, which is a metal? Explain its reaction with oxygen.

(7) A tapping vessel opens in a tank-like container that is tapering on the lower side. The tank has an outlet for water on the upper side and a water inlet on the lower side. Finely ground ore is released in the tank. A forceful jet of water is introduced in the tank from the lower side and gangue particles and pure ore are separated by this method.

(i) The above description is of which gravitation separation method?

(ii) Draw a labelled diagram of this method.

3. Attempt any five of the following questions: **15**

(1) What would be the value of 'g' on the surface of the earth if its mass was twice and its radius half of what it is now?

(2) Write the merits of Mendeleev's periodic table.

(3) Study the following chemical reaction and answer the questions given below:

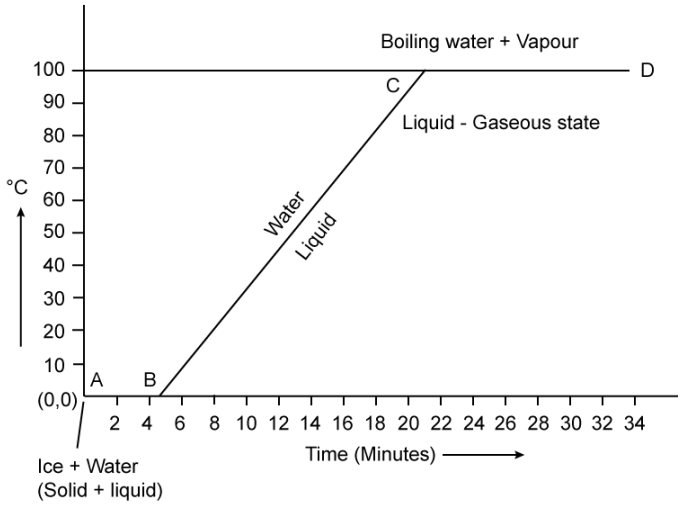
$$AgNO_{3(aq)} + NaCl_{(aq)} \longrightarrow AgCl_{(s)} \downarrow + NaNO_{3(aq)}$$

(i) Identify and write the type of chemical reaction.

(ii) Write the definition of the above type of chemical reaction.

(iii) Write the names of reactants and products of the above reaction.

(4) Explain the following temperature vs time graph:



(5) Surabhi from Std. X uses spectacles. The power of the lenses in her spectacles is 0.5 D.

Answer the following questions from the given information:

(i) Identify the type of lenses used in her spectacles.

(ii) Identify the defect of vision Surabhi is suffering from.

(iii) Find the focal length of the lenses used in her spectacles.

(6) Complete the following table:

Sr.No.	Common Name	Structural Formula	IUPAC Name
1.	Ethylene	$CH_2=CH_2$	……
2.	……..	CH_3COOH	Ethanoic acid
3.	Methyl alcohol	……..	Methanol

(7) What is meant by space debris? Why is there need to manage the debris?

(4) Answer any one of the following questions: **5**

(1) Taking into consideration the period of the elements given below, answer the following questions:

Elements	Atomic Radius (pm)
O	66
B	88
C	77
N	74
Be	111
Li	152

(i) Arrange the above elements in a decreasing order of their atomic radii.

(ii) State the period to which the above elements belong.

(iii) Why this arrangement of elements is similar to the above period of the modern periodic table?

(iv) Which of the above elements have the biggest and the smallest atom?

(v) What is the periodic trend observed in the variation of atomic radius while going from left to right within a period?

(2) Observations made by Swarali while doing experiments are given below. Based on these, write answers to the questions:

Swarali found that the light ray travelling from the denser medium to the rarer medium goes away from the normal. If the angle of incidence (i) is raised by Swarali, the angle of refraction (r) went on increasing. However, after a certain value of the angle of incidence, the light ray is seen to return back into the denser medium.

Questions:

(i) What is the specific value of $\angle i$ called?

(ii) What is the process of reflection of incident ray into denser medium called?

(iii) Draw the diagrams of three observations made by Swarali.

Maharashtra State Board
Class X Science and Technology Paper I
Board Paper – 2019 Solution

1.

(A)

(1) If $F = \frac{Gm_1m_2}{d^2}$, then $F = \boxed{\frac{Gm_1m_2}{9d^2}}$

(2) According to the law of Dobereiner's triads, the atomic mass of Na is the average of the atomic masses of Li and K.
Atomic mass of Na
$= \frac{6.9+39.1}{2}$
$= 23$

(3) False. A concave lens is a diverging lens.

(4) Hubble telescope: 569 km high from the earth's surface
Revolving orbit of the Hubble telescope: Low earth orbit

(5) Froth flotation. Others are the processes of coating a thin layer of metal on the surface of other metals.

(B)

(1) (c) Displacement
The reaction of an iron nail with copper sulphate solution is a displacement reaction.

(2) (d) The intensity of a magnetic field in A is less than in B.

(3) (b) 40°
A ray of light makes an angle of 50° with the surface S_1 of the glass slab. Its angle of incidence will be 40°.

(4) (b) 4
Water expands on reducing its temperature below 4°C.

(5) (a) Edible oil
The carbon compound used in daily life is edible oil.

2.

(1) Given:

$P_1 = 50$ W

$P_2 = 60$ W

$V = 220$ V

$I = ?$

We know

$$I = \frac{P}{V}$$

$$I_1 = \frac{P_1}{V} \text{ and } I_2 = \frac{P_2}{V}$$

$$I = I_1 + I_2$$

$$I = \frac{P_1}{V} + \frac{P_2}{V}$$

$$= \frac{P_1 + P_2}{V}$$

$$= \frac{50+60}{220}$$

$$= \frac{110}{220}$$

$$I = 0.5\,A$$

A current of 0.5 A will flow through the main conductor.

(2) The working of electric equipment like iron, electric heater, boiler, toaster etc. is based on the heating effect of electric current.

An alloy such as nichrome has high resistivity, and it can be heated to high temperature without oxidation.

Hence, nichrome is used in electric equipment producing heat such as iron, electric heater, boiler and toaster.

(3) Given:

$s = 490$- m

$a = g = 9.8$ m/s^2

$u = 0$ m/s^2

$t = ?$

We know

$$s = ut + \frac{1}{2}at^2$$

$$490 = 0 + \frac{1}{2} \times 9.8 t^2$$

$$t^2 = 4.9$$

$$t^2 = \frac{490}{4.9}$$

$$t = 10\,s$$

The time required is 10 s.

(4) First four members of a homologous series of alcohols are

Methanol (CH_3OH)

Ethanol (C_2H_5OH)

Propanol (C_3H_7OH)

Butanol (C_4H_9OH)

(5)

Points	Answers
(i) Position of the object	Between F_1 and O
(ii) Position of the image	On the same side of the lens as the object
(iii) Size of the image	Very large
(iv) Nature of the image	Virtual and erect

(6) Sodium is a metal.

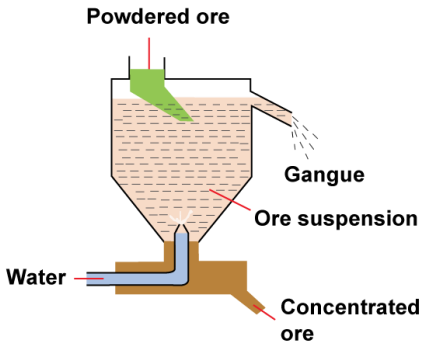
Sodium reacts with oxygen at room temperature to form sodium oxide.

$$\underset{\text{Sodium}}{4Na} + \underset{\text{Oxygen}}{O_2} \longrightarrow \underset{\text{Sodium oxide}}{2Na_2O}$$

(7)

(i) Hydraulic separation method

(ii) Diagram:



Hydraulic separation

3.

(1) Given:

$M_2 = 2M_1$

$R_2 = \frac{1}{2}R_1$

We know,

$$g = \frac{GM}{R^2}$$

$$g_1 = \frac{GM_1}{R_1^2}$$

$$g_2 = \frac{GM_2}{R_2^2}$$

$$\therefore \frac{g_2}{g_1} = \frac{M_2}{M_1} \times \frac{R_1^2}{R_2^2}$$

$$= \frac{2M_1}{M_1} \times \frac{R_1^2}{1/2\, R_1^2}$$

$$= 2 \times (2)^2$$

$$\frac{g_2}{g_1} = 8$$

$$g_2 = 8g_1$$

The value of 'g' on the surface of the earth will be eight times the present value.

(2) Merits of Mendeleev's periodic table:

(i) To give proper place in the periodic table in accordance with properties, atomic masses of some elements were revised.

(ii) Mendeleev kept vacant places in the periodic table for elements not discovered till then. Later on, these elements were discovered and the properties of these elements matched well with those predicted by Mendeleev.

(iii) There was no place reserved for noble gases in Mendeleev's original periodic table. However, when noble gases such as helium, neon and argon were discovered, Mendeleev created the 'zero' group without disturbing the original periodic table and in which the noble gases were fitted very well.

(3)

(i) It is a double displacement type of reaction.

(ii) The reaction in which the ions in the reactants are exchanged to form a precipitate is called a double displacement reaction.

(iii) The reactants are silver nitrate and sodium chloride.

The products are silver chloride and sodium nitrate.

(4) The graph shows changes occurring when a mixture of ice and water is heated.

- The temperature of the mixture remains constant till all the ice melts as shown by the line AB. This temperature is the melting point of ice.
- On further heating, the temperature rises steadily from 0°C to 100°C shown by the line BC. At 100°C, water starts converting to steam and it is the boiling point of water.
- Further heating does not change the temperature, as shown by the line CD.

(5)

(i) The lenses used in Surbhi's spectacles are convex lenses.

(ii) Surbhi is suffering from hypermetropia.

(iii) Focal length of the lenses:

$$\frac{1}{\text{Power of the lens}} = \frac{1}{0.5\text{D}} = 2\text{m}$$

(6)

Sr. No.	**Common Name**	**Structural Formula**	**IUPAC Name**
1.	Ethylene	$CH_2 = CH_2$	Ethene
2.	Acetic acid	CH_3COOH	Ethanoic acid
3.	Methyl alcohol	CH_3OH	Methanol

(7) Non-functional satellites, parts of launchers detached during launching and debris generated due to collisions between satellites or other objects in space comprise space debris.

This debris can be harmful to artificial satellites. It can collide with these satellites or spacecraft and damage them. Because this debris is increasing day by day, it will be difficult to launch new spacecraft in the future. Therefore, it is essential to manage space debris.

4.

(1)

(i) Decreasing order of atomic radii:

Li > Be > B > C > N > O

(ii) The elements belong to Period 2.

(iii) On moving left to right within a period, the atomic number increases by one, the positive charge on the nucleus increases by one unit, but the electrons are added to the same orbit. Therefore, the nuclear pull increases and the atomic size decreases.

(iv) Lithium has the biggest atom and oxygen has the smallest atom.

(v) Atomic radius decreases while going from left to right within a period.

(2)

(i) The specific value of ∠i is called the critical angle.

(ii) It is total internal reflection.

(iii) Diagram: