

SCIENCE & TECHNOLOGY (PART 1)

SCIENCE & TECHNOLOGY (PART 1) **BOARD'S ACTIVITY SHEET (MARCH 2021)**

Time : 2 Hours]

[Total Marks : 40

[NOTE : This examination was not conducted due to Covid-19.]

SCIENCE & TECHNOLOGY (PART 1)
BOARD'S ACTIVITY SHEET (SEPTEMBER 2021)
(With Full Solution)

Time : 2 Hours]

[Total Marks : 40

Note : (i) All questions are compulsory.

(ii) Use of a calculator is not allowed.

(iii) The numbers to the right of the questions indicate full marks.

(iv) In case of MCQs (Q. No. 1(A), only the first attempt will be evaluated and will be given credit.

(v) For each MCQ, the correct alternative (A), (B), (C) or (D) with subquestion number is to be written as an answer.

E.g. : (i) (A), (ii) (B), (iii) (C).

(vi) Scientifically correct, labelled diagrams should be drawn wherever necessary.

Q. 1. (A) Write the correct alternative :

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(i) When current I , flows through a circuit with resistance R , the heat produced in the resistor in time t will be

(A) IRt

(B) IR^2t

(C) I^2Rt

(D) IRt^2

(ii) element belongs to the eighteenth group.

(A) Na

(B) Cl

(C) Fe

(D) Ne

(iii) is a satellite launch vehicle.

(A) $PSLV$

(B) $GSAT$

(C) $IRNSS$

(D) $INSAT$

(iv) The phenomenon in which the ice converts to liquid due to applied pressure and then reconverts to ice once the pressure is removed is called

(A) boiling

(B) regelation

(C) freezing

(D) evaporation

(v) As we go above the earth's surface, the value of g

(A) increase

(B) becomes zero

(C) doesn't change

(D) decreases

Q. 1. (B) Answer the following :

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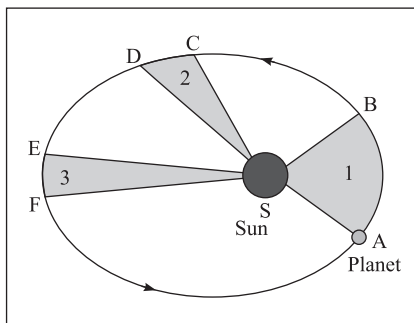
(i) Find the co-relation :

Object at infinity : At focus F_2 :: Object between F_1 and $2F_1$:

(ii) State whether the given statement is true or false :

In a chemical equation, the reactants are written on the right hand side and the products on the left hand side.

(iii) Name the law shown in the given figure :



(iv) Match the correct pair :

| Column A | Column B |
|------------------------------|---|
| Anomalous behaviour of water | (a) 0°C to -10°C (b) 0°C to 4°C (c) 0°C to 10°C |

(v) What is meant by space debris?

Q. 2. (A) Give scientific reasons : (any two)

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(i) Elements belonging to the same group have the same valency.

(ii) It is necessary to have earthing connections in home electrical circuits.

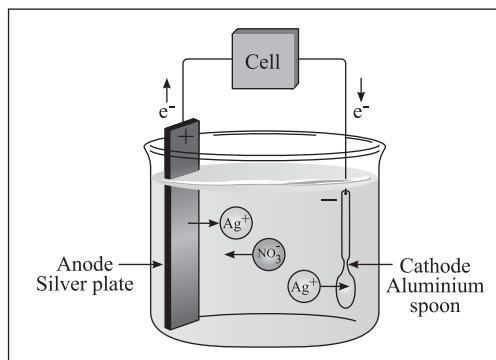
(iii) Sodium is always kept in kerosene.

Q. 2. (B) Answer the following questions : (any three)

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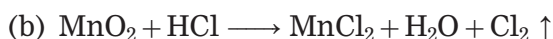
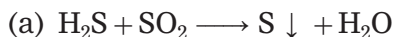
(i) A tennis ball is thrown up and reaches a height of 5 m before coming down. What was its initial velocity? (Assume $g = 10 \text{ m/s}^2$).

(ii) Identify the process shown in the figure and write its two uses :



(iii) State the Laws of Refraction.

(iv) Balance the given chemical equations : (Do not write the steps.)



(v) Write a note on Persistence of Vision.

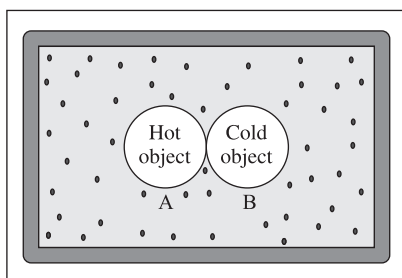
Q. 3. Answer the following : (any five)

15

(i) (a) What is the chemical formula of rust?

(b) Give the electrochemical reaction of rusting of iron at anode and cathode region.

(ii) Answer the questions with reference to the given figure :



(a) From where to where is heat transferred?

(b) Which principle do we learn about from this process?

(c) Which property of the substance is measured using this principle?

(iii) The electronic configuration of metal A is 2, 8, 1 and that of metal B is 2, 8, 2 :

(a) Which of the two metals is more reactive?

(b) Identify the name of the more reactive element.

(c) Write its reaction with dilute hydrochloric acid.

(iv) Complete the following table :

| | | |
|-------|----------------------------------|----------------------------|
| IRNSS | ----- | ----- |
| ----- | Weather study and predict | ----- |
| ----- | ----- | Earth's observation |

(v) Write any three points of differentiation between Myopia and Hypermetropia.

(vi) Saturated hydrocarbons are classified into three types. Write these names giving *one* example each.

(vii) Who will spend more electrical energy 500 W TV set in 30 minutes or 600 W heater in 20 minutes?

(viii) State the demerits of Mendeleev's periodic table.

Q. 4. Answer the following questions : (*any one*)

5

- (i) With the help of a neat labelled diagram explain – A rainbow is the combined effect of refraction, dispersion and total internal reflection of light.
 - (ii) Answer the following :
 - (a) Draw a neat labelled diagram for esterification reaction.
 - (b) Give the molecular formula for ester.
 - (c) State the property of ester.
 - (d) Give two uses of ester.
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SOLUTION : BOARD'S ACTIVITY SHEET (SEPTEMBER 2021)

Q. 1. (A)

- (i) (C)
- (ii) (D)
- (iii) (A)
- (iv) (B)
- (v) (D)

Q. 1. (B)

- (i) Beyond $2F_2$
- (ii) False
- (iii) From the given description we understand Kepler's three laws.
- (iv) Anomalous behaviour of water -0°C to 4°C .
- (v) In a space nonessential objects such as the parts of launchers and satellites, revolving around the earth are called the debris in space.

Q. 2. (A)

- (i) (1) The valency of an element is determined by the number of valence electron in the outermost shell of an atom of an element.
- (2) All the elements in a group have the same number of valence electrons. Therefore, elements in the same group should have the same valency. For example, the elements of group I contain only one valence electron; the valency of elements of group I is one. Similarly for group II, the valency is two.
- (ii) (1) The live and the neutral wires have potential difference of 220 V. The 'earth' wire is connected to the ground.
- (2) Due to a fault in the equipment or if the plastic coating on the live and neutral wire gives away.
- (3) The two wires come in contact with each other and a large amount of current flows through it producing heat. To prevent this excess flow of current earthing wire is used to prevent from shock.
- (iii) (1) Sodium reacts so vigorously with atmospheric oxygen that it catches fire if kept in the open.
- (2) It does not react with kerosene and sinks in it. Hence, to protect sodium and to prevent accidental fires it is always kept in kerosene.

Q. 2. (B)

- (i) Data : $h = 5 \text{ m}$, $g = 10 \text{ m/s}^2$, $v = 0 \text{ m/s}$, $u = ?$

As the object moves upwards,

$$v^2 = u^2 + 2as$$

$$= u^2 + 2(-g)h \quad (\because a = -g)$$

Now, $v = 0 \text{ m/s}$

$$u^2 = 2gh = 2 \times 10 \text{ m/s}^2 \times 5 \text{ m}$$

$$u^2 = 100 \text{ (m/s)}^2$$

$$\therefore u = 10 \text{ m/s}$$

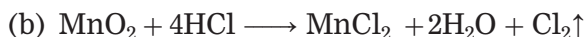
- (ii) In the figure, Process of Electroplating is shown.

Use : (i) Silver-plated spoon (ii) Gold-plated ornament.

(iii) Laws of refraction of light :

(1) The incident ray and the refracted ray are on the opposite sides of the normal to the surface at the point of incidence and all the three, i.e., the incident ray, the refracted ray and the normal are in the same plane.

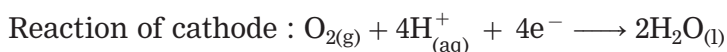
(2) For a given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant (Snell's law). This constant is called the refractive index of the second medium with respect to the first medium.



- (v) **Persistence of vision :** We see an object when its image is formed on the retina. The image disappears when the object is removed from our sight. But this is not instantaneous and the image remains imprinted on the retina for about $\frac{1}{16}$ th of a second after the removal of the object. The sensation on the retina persists for a while. This effect is known as the persistence of vision. It is due to persistence of vision that we continue to see the object in its position for about $\frac{1}{16}$ th of a second after it is removed.

Example : When a burning stick of incense is moved fast in a circle, a circle of red light is seen.

Q. 3. (i) (a) Chemical formula of rust : $\text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$



- (ii) (a) Hot object to cold object.

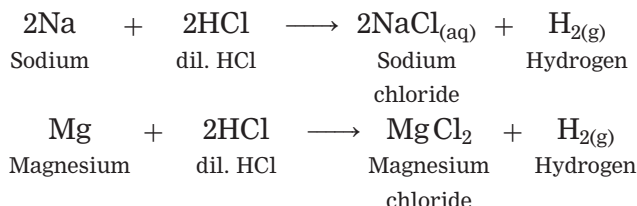
(b) Principle of heat exchange.

(c) Specific heat of substance.

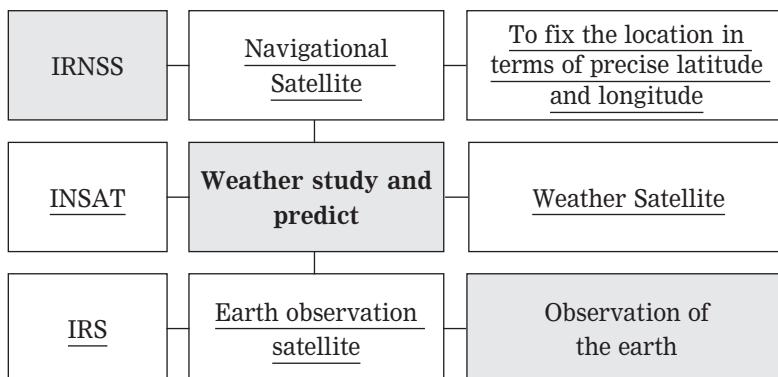
(iii) (a) If the number of electrons in the outermost orbit is less, then the metal is more reactive. Metal A contains one electron in the outermost shell, while metal B contains two electrons. Hence, metal A is more reactive than metal B.

(b) Metal A is sodium and metal B is magnesium.

(c) Reactions of Na and Mg with dil. HCl are,



(iv)



(v)

| Farsightedness (Hypermetropia) | Nearsightedness (Myopia) |
|--|--|
| 1. In hypermetropia, a human eye can see distant objects distinctly but is unable to see nearby objects clearly. | 1. In myopia, a human eye can see near objects distinctly, but is unable to see distant objects clearly. |
| 2. Possible reasons of the defect : | 2. Possible reasons of the defect : |
| (i) The curvature of the cornea and the eye lens decreases. Hence, the converging power of the eye lens becomes less. | (i) The curvature of the cornea and the eye lens increases. The muscles near the lens cannot relax so that the converging power of the lens remains large. |
| (ii) The distance between the eye lens and retina decreases (relative to the normal eye) and the focal length of the eye lens becomes very large due to the flattening of the eyeball. | (ii) The eyeball elongates so that the distance between the lens and the retina increases. |

| Farsightedness (Hypermetropia) | Nearsightedness (Myopia) |
|--|--|
| 3. In this case, the image of a nearby object would be formed behind the retina. | 3. In this case, the image of a distant object is formed in front of the retina. |
| 4. This defect can be corrected using a convex lens of appropriate power. | 4. This defect can be corrected using a concave lens of appropriate power. |

(Note : Students should write required points according to marks allotted for question.)

- (vi) (i) Straight chain – Propane (C_3H_8)
(ii) Branched chain – Isobutane (C_4H_{10})
(iii) Cyclic hydrocarbon – Cyclohexane (C_6H_{12})

(vii) Data : $P_1 = 500 \text{ W}$, $P_2 = 600 \text{ W}$

$$t_1 = 30 \text{ min} = \frac{30}{60} \text{ h} = \frac{1}{2} \text{ h} ,$$

$$t_2 = 20 \text{ min} = \frac{20}{60} \text{ h} = \frac{1}{3} \text{ h}$$

Electrical energy used = Pt

$$\text{TV set : } P_1 t_1 = 500 \text{ W} \times \frac{1}{2} \text{ h} = 250 \text{ W}\cdot\text{h}$$

$$\text{Heater : } P_2 t_2 = 600 \text{ W} \times \frac{1}{3} \text{ h} = 200 \text{ W}\cdot\text{h}$$

Thus, the TV set will spend more electrical energy than the heater.

- (viii) (1) The elements cobalt (Co) and nickel (Ni) have the same whole number atomic mass. As a result there was an ambiguity regarding their sequence in Mendeleev's periodic table.
- (2) Isotopes were discovered long time after Mendeleev put forth the periodic table. A challenge was posed in placing isotopes in Mendeleev's periodic table as isotopes have the same chemical properties but different atomic masses.
- (3) The rise in atomic mass does not appear to be uniform when elements are arranged in an increasing order of atomic masses. It was not possible, therefore, to predict how many elements could be discovered between two heavy elements.
- (4) Position of hydrogen : Hydrogen shows similarity with halogens (group VII). For example, the molecular formula of hydrogen is H_2 while the molecular formulae of fluorine and chlorine are F_2 and Cl_2 , respectively. In the same way, there is a similarity in the chemical properties of hydrogen and alkali metals (group I). There is a similarity in the molecular

formulae of the compounds of hydrogen alkali metals (Na, K, etc.) formed with chlorine and oxygen. On considering the above properties, it is difficult to decide the correct position of hydrogen whether it is in the group of alkali metals (group I) or in the group of halogens (group VII).

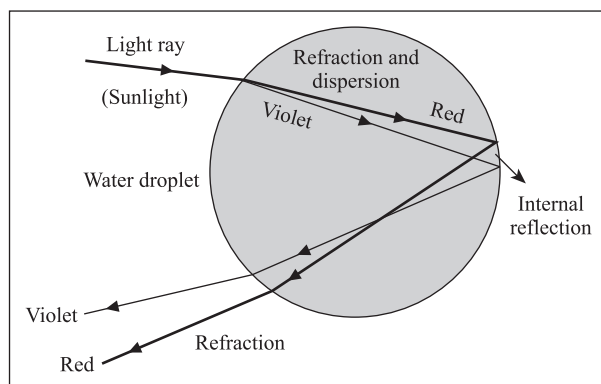
| Compounds of H | Compounds of Na |
|------------------|-------------------|
| HCl | NaCl |
| H ₂ O | Na ₂ O |
| H ₂ S | Na ₂ S |

Similarity in hydrogen and alkali metals

| Element (Molecular formula) | Compounds with metals | Compounds with nonmetals |
|-----------------------------------|--------------------------|--------------------------------|
| H ₂ | NaH | CH ₄ |
| Cl ₂ | NaCl | CCl ₄ |

Similarity in hydrogen and halogens

- Q. 4. (i)** (1) The formation of a rainbow in the sky is a combined result of refraction, dispersion, internal reflection and again refraction of sunlight by water droplets present in the atmosphere after it has rained.



Formation of a rainbow (Schematic diagram)

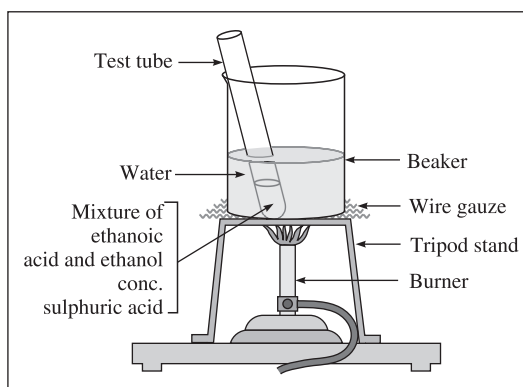
Here, for simplicity only violet and red colours are shown. The remaining five colours lie between these two.

- (2) The sunlight is a mixture of seven colours : violet, indigo, blue, green, yellow, orange and red. After it has stopped raining, the atmosphere contains a large number of water droplets. When sunlight is incident on a water droplet, there is (i) refraction and dispersion of light as it passes from air to water (ii) internal reflection of light inside the droplet and (iii) refraction of light as it passes from water to air.

- (3) The refractive index of water is different for different colours, being maximum for violet and minimum for red. Hence, there is dispersion of light (separation into different colours) as it passes from air to water. [See figure for reference.]
- (4) The combined action of different water droplets, acting like tiny prisms, is to produce a rainbow with red colour at the outer side and violet colour at the inner side. The remaining five colours lie between these two.

The rainbow is seen when the sun is behind the observer and water droplets in the front.

(ii) (a)



- (b) $\text{CH}_3 - \text{COO} - \text{CH}_2 - \text{CH}_3$.
- (c) Esters have sweet odour.
- (d) (1) Making fragrances. (2) Making flavouring agents.

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