Maharashtra State Board
Class IX
Science and Technology Term II
Paper – I Solutions

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1. (A)

(1)

(i) Velocity of sound is directly proportional to the square root of temperature of the medium.

(ii) Alkenes have the general formula C_nH_{2n}.

(iii) Strontium-90 is used as a tracer in the research of various crops.

(B)

(i) False. Infinite images are formed by mirrors when they are placed parallel to each other.

(ii) True.

2.

(1) (c) 17.2 metres

We know that the speed of sound at 22°C = 344m/s

Minimum time interval between sound emitted and reflected sound= 0.1s

Distance travelled by the sound to incident and reach back to the source is given by,

distance = speed $\times$ time

$= 344 \times 0.1$

$= 34.4$m

Thus the distance between reflected surface and the source must be half of the distance travelled by the sound= $\frac{34.4}{2} = 17.2$m

(2) Red colour used on Rang Panchami contains a high proportion of mercury.

(3) (d) Real, inverted, highly magnified

As the image formed is inverted and at infinity, the image is real, inverted and high magnified.

(4) Among all types of coal available, anthracite contains the maximum percentage of carbon (95%).

(5) (b) Children below 5 years can hear sounds up to a frequency of 25 kHz.

3.

(1) Focal length of a concave mirror = 15 cm

We know that the focal length is half the radius of curvature.

$\therefore f = \frac{R}{2}$

$\Rightarrow R = 2f$

$\therefore R = 2 \times 15 = 30cm$

(2)

Diamond	Graphite
Pure diamond is colourless and transparent.	Graphite is greyish black, opaque and shiny.
It is the hardest naturally occurring substance.	It is soft and greasy to touch.
It has a high density, i.e. 3.5 g/cm^3.	It has a comparatively low density, i.e. 2.39 g/cm^3.
It is a bad conductor of electricity.	It is a good conductor of electricity.

(3) Wavelength of sound waves = 0.02 m

Velocity of sound = 330 m/s

Frequency of sound waves= $\nu = \frac{v}{\lambda} = \frac{330}{0.02} = 16500 \text{ Hz} = 16.5 \text{ kHz}.$

(4) Teflon coating is given to coloured metal sheets of two-wheelers and four-wheelers as

- The atmosphere and chemical substances have no effect on Teflon.
- Teflon coating protects them from damage due to high temperature and rain.

(5)

a) A convex mirror is also called a dispersing mirror.

b) The image formed by this mirror is always small in size, virtual and erect.

(6) Harmful effects of artificial food colours:

i. Food colours added to pickles, jams and sauces contain small quantities of lead and mercury. These can be harmful for those who consume these products on a regular basis.

ii. Diseases like ADHD (Attention Deficit Hyperactivity Disorder) can affect children who consume foods with added food colours, especially when such food is consumed in excess.

(7) SONAR: **SO**und **N**avigation **A**nd **R**anging

Applications:

a) To find the depth of the sea and ocean floor

b) To search and locate underwater hills, valleys, troughs and icebergs

4.

(1) Chemical name of bleaching powder:

$CaOCl_2$ - Calcium oxychloride

Reaction involved in the preparation:

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Uses of bleaching powder:

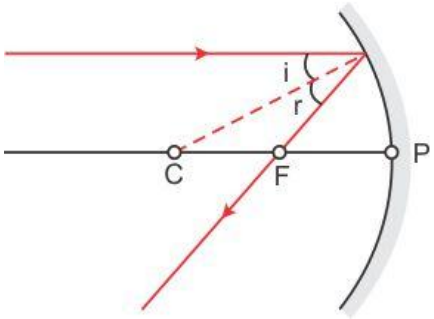
It is used for disinfecting drinking water.

It is used for bleaching of cloth.

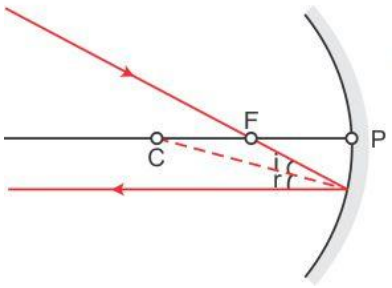
(2)

Rules based on the laws of reflection of light for drawing a ray diagram are:

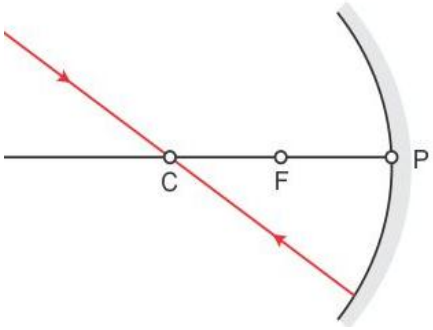
Rule 1: If an incident ray is parallel to the principal axis, then the reflected ray passes through the principal focus.



Rule 2: If an incident ray passes through the principal focus of the mirror, then the reflected ray is parallel to the principal axis.



Rule 3: If an incident ray passes through the centre of curvature of the mirror, then the reflected ray traces the same path back.



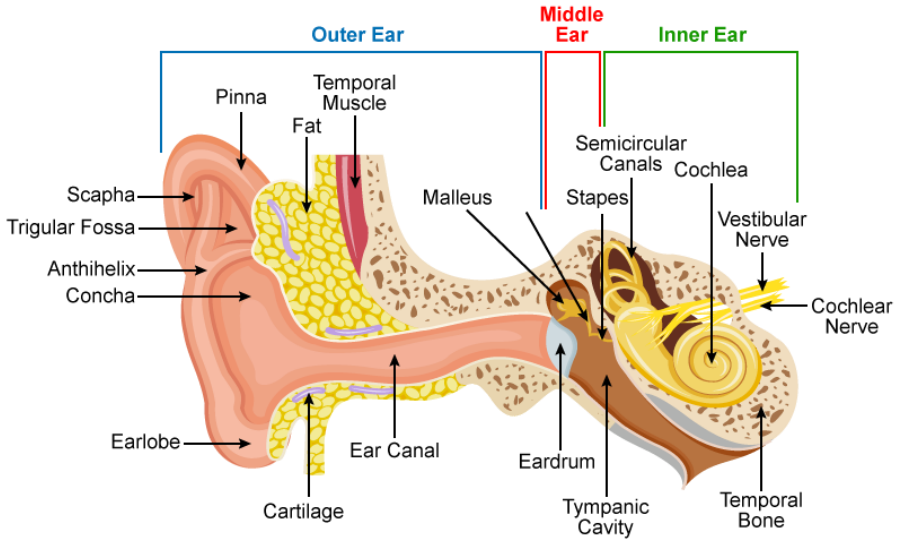
(3) In the presence of UV light and at a temperature of 250°C to 400°C, methane and chlorine react to give methyl chloride.
This reaction is called chlorination of methane.

$$CH_4 + Cl_2 \xrightarrow{\text{Light}} CH_3Cl + HCl$$

Uses of methane:

- Methane is used as natural gas in fabric mills, paper mills, food processing industries and petroleum purification plants.
- It is used for production of organic compounds such as ethanol, methyl chloride, methylene chloride and acetylene.
- It is used as domestic fuel.

(4)



Outer ear or pinna:

a) It collects the sound waves coming from the source of sound.
b) It has a funnel-like shape.
c) This peculiar shape of it makes it possible to collect the sound waves and pass them to the middle ear.
d) The collected sound waves pass through the tube to the cavity in the middle ear.

(5) Uses of radioisotopes:

1. Medical Science

Polycythaemia: Red blood cell count increases in this disease.
Phosphorus-32 is used in its treatment.

Bone cancer: Strontium-89, Strontium-90, Samarium-153 and Radium-223 are used in the treatment of bone cancer.

Hyperthyroidism: It occurs due to overproduction of hormones by the thyroid gland. Iodine-123 is used in its treatment.

Tumour detection: Boron-10, Iodine-121 and Cobalt-60 are used in the treatment of brain tumours.
Arsenic-74 is used in the detection of small tumours in the body.

2. Field of Agriculture

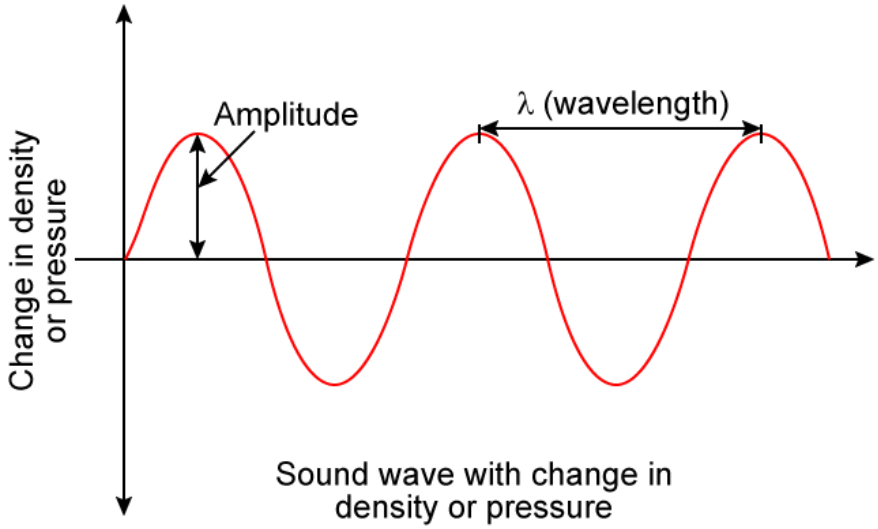
Cobalt-60 is used for food preservation.
Genes and chromosomes of the seeds can be modified by means of radiation.
Strontium-90 is used as a tracer in the research of various crops.

3. Industrial Field

Radiography: This technique is used for detecting flaws in metal work. Isotopes such as Cobalt-60 and Iridium-192 are used in the radiography camera.

Luminescent paint and radio luminescence: Radioactive substances such as radium, promethium and tritium with phosphor are used to make certain objects visible in the dark.

(6)



(7) Water of Crystallisation

Water molecules which form part of the structure of a crystal are called water of crystallisation.

Some substances in daily use which contain water of crystallisation:

Alum (Potash alum: $K_2SO_4.Al_2(SO_4)_3.24H_2O$)

Borax ($Na_2B_4O_7.10H_2O$)

Epsom salt (Magnesium sulphate: $MgSO_4.7H_2O$)

Barium chloride ($BaCl_2.2H_2O$)

Sodium sulphate (Glauber's salt: $Na_2SO_4.10H_2O$)

Uses:

Alum is used in the process of purification of water.

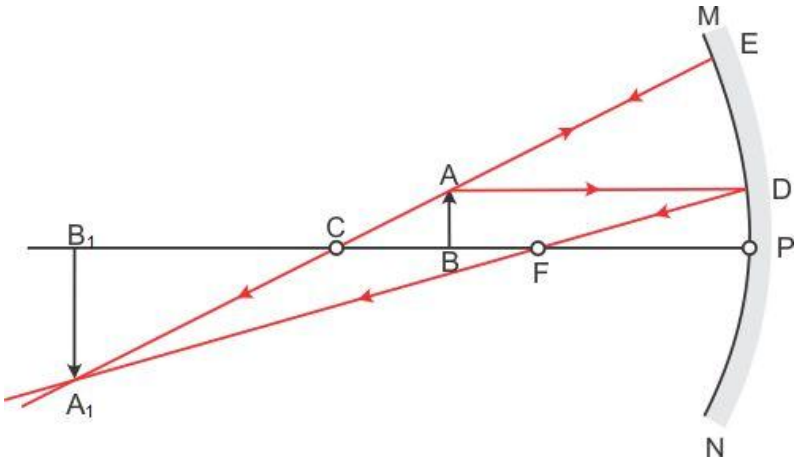
Blue vitriol is used in the test for diagnosing anaemia.

5.

(1)

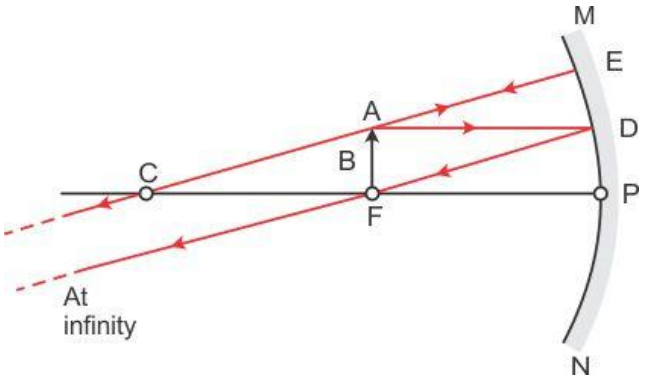
(a)

Position of object	Position of image	Size of image	Nature of image
Between C and F	Beyond C	Magnified	Real and inverted



(b)

Position of object	Position of image	Size of image	Nature of image
At focus	At infinity	Highly magnified	Real and inverted



(2) Crystalline allotropes of carbon:

1. Diamond
2. Graphite
3. Fullerene

Uses of Diamond:

i. Diamonds are used in ornaments.
ii. Being the hardest substance, diamond is used to cut glass and other metals.
iii. Diamond-tipped tools are used for cutting and drilling of rocks.
iv. Diamond absorbs harmful radiation. Hence, it is used in space satellites to make radiation-proof windows.

(any two)

Uses of Graphite:

i. Being soft and slippery with a high melting point, graphite is used as a lubricant in fast-moving machinery.
ii. It is used to make the core of lead pencils.
iii. It is used in a carbon brush, an important part of dynamos and electric motors.
iv. In a dry cell, a graphite rod is used as the positive electrode.
v. Graphite is also used in arc lamps which gave very bright light.

(any two)

Uses of Fullerene:

i. Fullerene is used as an insulator.
ii. It is used as a catalyst in water purification.
iii. At a certain temperature, it exhibits superconductivity.

(any two)