ICSE Board
Class IX Physics
Paper – 1 Solution

SECTION I

Answer 1

(a) Wavelength of yellow light = 589nm

1 nm= 10^{-9} m

589 nm = 589 x 10^{-9}m =5.89 x 10^{-7} m

As numerical value is greater than 3.2, the order of magnitude is 10^{-6} m.

(b)

i. A screw gauge can be used to determine the diameter of a thin wire.

ii.

(a) Vernier calipers.

(b) Metre scale.

(c) Screw gauge.

(c) The order of magnitude of a physical quantity is its magnitude in powers of ten when that physical quantity is expressed in powers of ten with one digit to the left of the decimal.

Examples:

If the volume of a room is 52.37 m^3 = 5.237 x 10^1 m^3, then its order of magnitude will be 10^2 m^3 (since, 5.237 > 3.2).

If the thickness of a card sheet is 0.0027 m = 2.7 x 10^{-3} m, then its order of magnitude will be 10^{-3} m (since, 2.7 < 3.2).

(d) The three units used to express small measurements of length are

i. Millimetre.

ii. Angstrom.

iii. Fermi.

(e) Three units of length which are bigger than a metre are:

i. decametre = 10 metres

ii. hectometre = 100 metres

iii. kilometre = 1000 metres

Answer 2

(a) Acceleration is defined as the rate of change of velocity with time. SI unit of acceleration is metre per second square (m s^{-2}).

(b) The body starts from rest; so, its initial velocity, u = 0
Final velocity of the body, v= 10 ms^{-1}
Time taken by the body to acquire this velocity, t = 2s
We know that v = u + at

$$a = \frac{v - u}{t}$$

$$= \frac{10 - 0}{2}$$

$$= 5\,m/s^2$$

The acceleration of the body = 5 m/s^2.

(c) According to Newton's third law of motion, to every action there is always an equal and opposite reaction.
No, action and reaction never act on the same body. They always act simultaneously on two different bodies.

(d) SI unit of linear momentum is kilogram metre per second (kg m s^{-1}).
1 kg m s^{-1} is the linear momentum possessed by a body of mass 1 kg moving with a velocity of 1ms^{-1}.

(e)

i. The force with which a body is attracted towards the centre of the earth is called its weight. The unit of weight is newton (N).
ii. The gravitational constant (G) is numerically equal to the gravitational force between two unit masses kept at unit distance apart. The value of G is equal to 6.67 x 10^{-11} $Nm^2\,kg^{-2}$.

Answer 3

(a) According to Newton's law of gravitation, every object in the universe attracts every other object with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.
The unit of gravitational force is newton (N).

(b)

i. The upward force exerted on a body by the fluid in which it is submerged, is called upthrust.
ii. The SI unit of measuring upthrust is newton (N).

(c)

i. With the increase in temperature, the density of water first increases (from 0^oC to 4^oC) and then decreases (above 4^oC).
ii. Density of iron = 7.8×10^3 kg m^{-3}
Density of water at 4^oC = 10^3 kg m^{-3}

$$\text{Relative density} = \frac{\text{Density of iron}}{\text{Density of water at } 4^oC}$$

$$= \frac{7.8 \times 10^3 \text{ kg m}^{-3}}{10^3 \text{ kg m}^{-3}} = 7.8$$

(d) Difference between heat and temperature

Heat	Temperature
1. Heat is a form of energy obtained due to the random motion of the molecules.	1. Temperature is a quantity which tells the degree of hotness and coldness of a body.
2. The measuring device is calorimeter.	2. The measuring device is thermometer.

(e) Liquid or gas containers are heated from the bottom for raising the temperature because liquids or gases are heated by convection in which heat is transferred upwards and not downwards or sideways.

Answer 4

(a)

i. The potential difference between two charged bodies is equal to the work done in moving a unit positive charge from one charged body to the other charged body through a metallic wire.

ii. The resistance of a conductor is said to be 1 ohm if a current of 1 ampere flows through it when the potential difference across it is 1 volt.

(b)

i. No, it is not possible to isolate the poles of a magnet.

ii. A line of force is a continuous curve in the magnetic field such that the tangent to it at any point gives the direction of the magnetic field at that point.

(c) The instruments used for detecting the electrical charge on a body are pith ball electroscope and gold leaf electroscope.

(d)

i. The sound of frequency greater than 20,000 Hz is called ultrasound.

ii. The speed of ultrasound in the air is approximately 330 m/s.

(e) If the object is moved closer to the surface of a convex mirror, then the size of the image gradually increases.

SECTION II

Answer 5

(a) Mass of the body = 0.8 kg

Acceleration of body = 2 ms^{-2}.

We know,

Force = mass x acceleration

Force = 0.8 x 2 = 1.6 N

(b) Acceleration due to gravity (g) is the acceleration experienced by a body during free fall. Its value is not constant.

At the earth's surface, the value of 'g' varies from place to place. On equator it is slightly less as compared to that at the poles. The mean value of 'g' at the surface of earth is taken to be 9.8 m/s^2. At altitudes above the earth's surface or at depth below the earth surface, the value of 'g' decreases. The value of 'g' is zero at the centre of the earth.

(c) Let the mass of X = M and mass of Y = m

Distance between X and Y = d

Gravitational force between X and Y is

$$F = G\frac{Mm}{d^2}$$

If mass of X is tripled, its new mass becomes 3M.

Now, gravitational force between X and Y is

$$F_{new} = G\frac{3Mm}{d^2} = 3G\frac{Mm}{d^2} = 3F$$

Therefore, the gravitational force between X and Y gets tripled.

Answer 6

(a) Thrust is the force acting normally on a surface while pressure is the thrust acting on unit area of the surface.

SI unit of thrust is newton (N) and SI unit of pressure is newton per metre square (N m^{-2}), also called as Pascal (Pa).

(b) Side of cube = 5 cm

Pressure at the centre of one face of cube is = 10 Pa

Area of one face, A = 5 cm × 5 cm = 25 cm^2 = 25 × 10^{-4} m^2

Thrust exerted by the liquid on this face is

F = P × A = 10 Pa × 25 × 10^{-4} m^2

F = 2.5 × 10^{-2} N

(c)

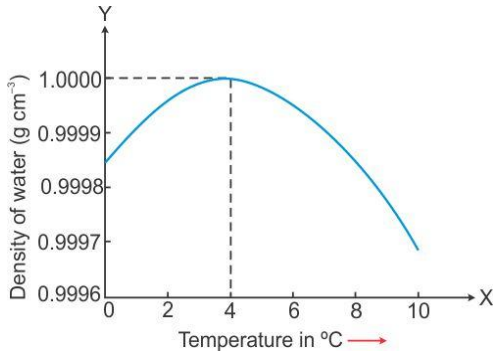
i. A diving suit is a garment or a device, designed to protect a diver from the underwater environment.
   Modern diving suits are of two kinds:
   1. Soft or ambient pressure diving suits.
   2. Hard or atmospheric pressure diving suits.

ii. Pressure is directly proportional to depth. The height of the blood column in the human body is more at the feet than at the brain; so, the blood exerts more pressure at the feet than at the brain.

Answer 7

(a) Density of a substance decreases with an increase in the temperature and increases with a decrease in the temperature.

(b) The expansion of water when it is cooled from 4°C to 0°C is known as anomalous expansion of water.
Graph showing the variation of density of water with temperature is shown below:



It can be seen from the graph that the density of water first increases from 0^0C to 4^0C and then decreases from 4^0C to 10^0C. The density of water is maximum at 4^0C.

(c)

i. Original length of aluminium bar = 100 cm

Rise in temperature = 100^0C - 20^0C = 80^0C

$\alpha = 0.000025^0C^{-1}$

$$\alpha = \frac{\text{Increase in length}}{\text{Original length} \times \text{Rise in temperature}}$$

$$0.000025 = \frac{\text{Increase in length}}{100 \times 80}$$

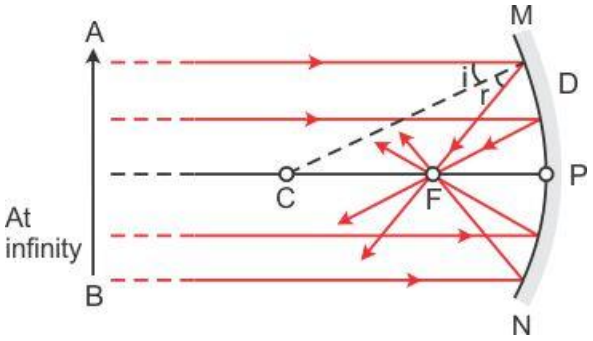
Increase in length = $0.000025 \times 100 \times 80$

= 0.2 cm

ii. The SI unit of heat is joule (J).

Answer 8

(a) A spherical mirror is a part of a hollow glass sphere silvered on one side.



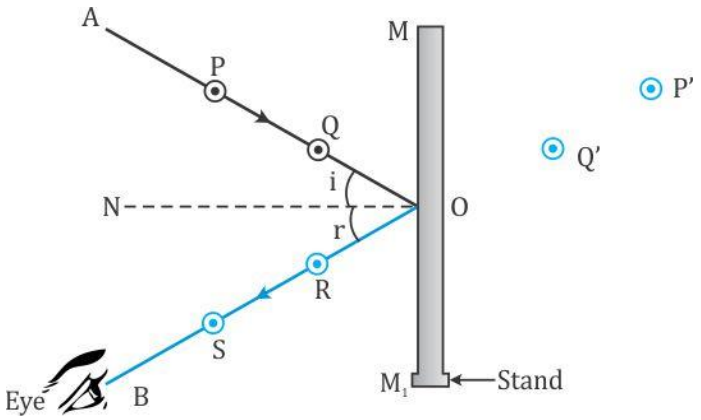
The parallel beam of light rays on reflection by a concave mirror converges at a point on the principal axis, midway between the pole and the centre of curvature. This point is called the principal focus.

(b) Reflection obeys the following two laws:

i. The incident ray, the reflected ray, and the normal at the point of incidence, all lie in the same plane.

ii. The angle of incidence and the angle of reflection are always equal.

(c) Experiment to verify laws of reflection:



Fix a sheet of white paper on a drawing board and draw a line MM_1 on it. On this line, take a point O nearly at the middle of it and draw a line OA such that $\angle MOA$ is less than 90^o. Then, draw a normal ON perpendicular to the line MM_1 at the point O. Now, set a small plane mirror vertical by means of a stand with its silvered surface along MM_1.

Now, fix two pins P and Q at some distance apart vertically on the line OA, on the board. Keeping the eye on the other side of the normal (but on the same side of the mirror), see clearly the images P' and Q' of the pins P and Q. Now, fix a pin R such that it is in line with the images of pins P and Q as observed in the mirror. Now, fix one more pin S such that the pin S is in line with the pin R and images P' and Q' of

pins P and Q. Remove the pins and draw a line OB joining the pin points S and R, which meets the surface of the mirror at O.

Now, AO is the incident ray and OB is the reflected ray. The lower tips of all the four pins lie on the plane of the paper. So, the incident ray, reflected ray and the normal, all lie in the same plane. Also, the angle of incidence ($\angle$AON) and angle of reflection ($\angle$BON) are equal.

Answer 9

(a) Characteristics of the medium required for the propagation of sound are:

i. The medium must possess elasticity so that the particles of the medium have a tendency to return to their original positions after displacement.

ii. The medium must be frictionless so that, there is no loss of energy during transmission.

iii. The medium must possess inertia so that, the particles of the medium have the ability to store energy.

(b)

i. Speed of sound increases with an increase in the temperature.

ii. Speed of sound is independent of the variation in pressure.

iii. Speed of sound increases with an increase in the humidity of the gas.

(c)

i. A distant lightning flash is seen before thunder because the velocity of flash (light) 3 x 10^8 m/s is much larger than the velocity of thunder (sound) in air (332 m/s).

ii. If we place our ear close to an iron railing which is tapped some distance away, we hear the sound twice because first we hear the sound that travels through the iron and then the sound that travels through air. This is due to the fact that speed of sound is more in solids and least in gases.

Answer 10

(a) Steps to reduce energy consumption:

i. Always use a source of energy which would do a large amount of work per unit volume or mass.

ii. Always use fuel saving devices such as pressure cooker etc.

iii. Always get the devices used regularly serviced in order to maintain their efficiency.

(b) Rheostat is used to regulate current in the circuit.

(c) The SI unit of potential difference is Volt (V).

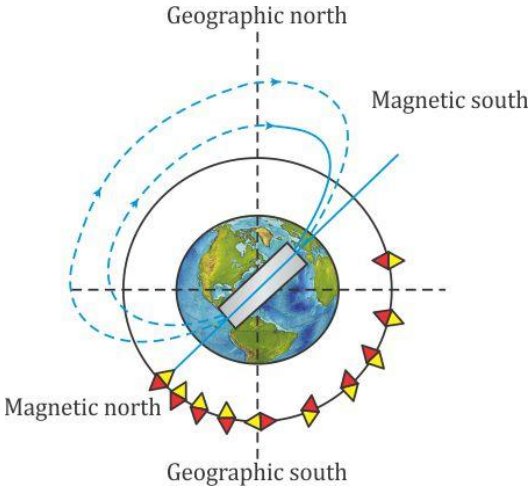
(d)

i. When a bar of soft iron is placed near a magnet then it acquires induced magnetism.

ii. When the magnet is removed, the iron bar loses its magnetism because iron has low retentivity.

(e)

i. Field lines of the Earth:



ii. Magnetic field lines of a bar magnet placed north-pointing north: