10th Class 2020		
Physics	Group-I	Paper-II
Time: 1.45 Hours	(Subjective Type)	Max. Marks: 48

(Part-I)

2. Write short answers to any Five (5) questions: (10)

(i) Define wave.

Ans A wave is a disturbance in the medium, which causes the particles of the medium to undergo vibratory motion about their mean position in equal intervals of time.

(ii) Derive a relation between speed, frequency and wavelength.

Ans Wave is a disturbance in a medium which travels from one place to another and hence has a specific velocity of travelling. This is called the velocity of wave, which is defined by:

$$\text{Velocity} = \frac{\text{distance}}{\text{time}}$$

$$v = \frac{d}{t}$$

If time taken by the wave in moving from one point to another is equal to its time period T, then the distance covered by the wave will be equal to one wavelength λ, hence we can write:

$$v = \frac{\lambda}{T}$$

But time period T, is reciprocal of the frequency f, *i.e.*,

$$T = \frac{1}{f}$$

Therefore, $v = f\lambda$

The above equation shows the relationship between speed, frequency and wavelength.

(iii) What is meant by ripple tank?

Ans Ripple tank is a device to produce water waves and to study their characteristics.

(iv) What is meant by loudness of sound?

Ans Loudness is the characteristic of sound by which loud and faint sounds can be distinguished.

(v) Write two uses of ultrasound.

Ans Two uses of ultrasound are:

1. Powerful ultrasound is now being used to remove blood clots formed in arteries.
2. It can also be used to get pictures of thyroid gland for diagnosis purposes.

(vi) Define reflection of sound.

Ans When sound is incident on the surface of a medium, it bounces back into the first medium. This phenomenon is called echo or reflection of sound.

(vii) Write two characteristics of focus of a concave and a convex mirror.

Ans Following are two characteristics of focus of a Concave Mirror:

1. The focus is in front of the mirror.
2. The focus is real as the rays of light after reflection converge at the focus.

Following are two characteristics of Focus of a Convex Mirror:

1. The focus lies behind the mirror.
2. The focus is virtual as the rays of light after reflection appear to come from the focus.

(viii) Define mirror formula.

Ans Mirror formula is the relationship between object distance p, image distance q from the mirror and focal length of the mirror.

Thus, we can write mirror formula as:

$$\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$$

3. Write short answers to any Five (5) questions: (10)

(i) Define Coulomb's law.

Ans The force of attraction or repulsion between two point charges is directly proportional to the product of the magnitude of charges and inversely proportional to the square of the distance between them.

(ii) What is the difference between variable and fixed type capacitor?

Ans In variable capacitor, the value of capacitance can be increased or decreased. In fixed type capacitors, the value of capacitance cannot be changed.

(iii) What is meant by damp conditions?

Ans Wet conditions are simply called damp conditions. Under damp condition, resistance of human skin is reduced drastically to few hundred ohms. Therefore, never operate any electrical appliance with wet hands. Also keep switches, plugs, sockets and wires dry.

(iv) What is the difference between galvanometer and ammeter?

Ans Galvanometer is a sensitive electrical instrument which detects current in a circuit; while ammeter is an instrument which measures larger current.

(v) What is the difference between a cell and a battery?

Ans The difference between a cell and a battery is that a cell is a single unit that converts chemical energy into electrical energy; And a battery is a collection of cells.

(vi) What do you know about paper capacitor?

Ans Paper capacitor is an example of fixed capacitors. The paper capacitor has a cylindrical shape. Usually, an

oiled or greased paper or a thin plastic sheet is used as a dielectric between two aluminium foils. The paper or plastic sheet is firmly rolled in the form of a cylinder and is then enclosed into a plastic case.

(vii) What is armature?

Ans In a practical electric motor, the coil, called the armature, is made of many loops mounted on a shaft or axle.

(viii) Define electromagnet.

Ans The type of magnet which is created when current flows through a coil.

4. Write short answers to any Five (5) questions: (10)

(i) Write down the symbol of OR gate.

Ans OR operation is represented by the symbol of plus (+).

(ii) What is meant by digital to analogue converter?

Ans In electronics, a digital-to-analogue converter (D.A.C) is a function that converts digital data into an analogue signal. D.A.C performs the reverse function.

(iii) Name the two factors which enhance thermionic emission.

Ans The two factors which enhance thermionic emission are:

1. Matter 2. Battery

(iv) Define telecommunication.

Ans The methods and means that are used to communicate information to distant places instantly is called telecommunication.

(v) Differentiate between RAM and ROM.

Ans Both RAM and ROM are the two parts of primary memory. ROM starts the computer while RAM vanishes when the computer is switched off.

(vi) **What is meant by cosmic radiation?**

Ans The Earth, and all living things on it also receive radiation from outer space. This radiation is called cosmic radiation, which primarily consists of protons, electrons, alpha particles and larger nuclei.

(vii) **Define nuclear fusion and write its equation.**

Ans "A process in which two light nuclei diffuse to form a heavier nucleus, with release of enormous amount of energy is called nuclear fusion reaction."

Equation:

$$^{2}_{1}H + ^{3}_{1}H \longrightarrow ^{4}_{2}H + ^{1}_{0}n + \text{energy}$$

(viii) **Write two characteristics of beta radiation.**

Ans Following are the two characteristics of beta radiation:

1. Beta radiation is a stream of high-energy electrons.
2. An unstable nucleus with excess of neutrons may eject beta radiations.

(Part-II)

NOTE: Attempt any Two (2) questions.

Q.5.(a) What is meant by simple harmonic motion (SHM)? Explain it with example of simple pendulum. (4)

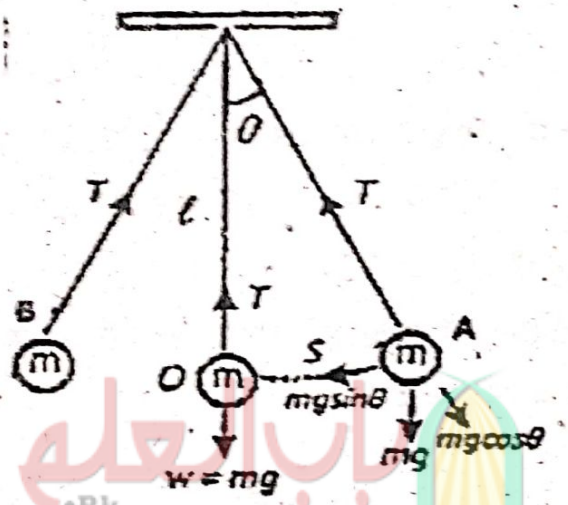
Ans **Simple Harmonic Motion (SHM):**

Simple harmonic motion occurs when the net force is directly proportional to the displacement from the mean position and is always directed towards the mean position.

In other words, when an object oscillates about a fixed position (mean position) such that its acceleration is directly proportional to its displacement from the mean position and is always directed towards the mean position, its motion is called SHM.

Example of Simple Pendulum:

A simple pendulum also exhibits SHM. It consists of a small bob of mass 'm' suspended from a light string of length 'l' fixed at its upper end. In the equilibrium position O, the net force on the bob is zero and the bob is stationary. Now if we bring the bob to extreme position A, the net force is not zero. There is no force acting along the string as the tension in the string cancels the component of the weight mg cos θ. Hence, there is no motion along this direction.



The component of the weight mg sin θ is directed towards the mean position and acts as a restoring force. Due to this force, the bob starts moving towards the mean position O. At O, the bob has got the maximum velocity and due to inertia, it does not stop at O rather it continues to move towards the extreme position B. During its motion towards point B, the velocity of the bob decreases due to restoring force. The velocity of the bob becomes zero as it reaches the point B.

The restoring force mg sin θ still acts towards the mean position O and, due to this force, the bob again starts moving towards the mean position O. In this way, the bob continues its to and fro motion about the mean position O.

It is clear from the above discussion that the speed of the bob increases while moving from point A to O due to the restoring force which acts towards O. Therefore, acceleration of the bob is also directed towards O. Similarly, when the bob moves from O to B, its speed decreases due to restoring force which again acts towards O. Therefore, acceleration of the bob is again directed towards O. It follows that the acceleration of the bob is always directed towards the mean position O. Hence the motion of a simple pendulum is SHM.

(b) Find the focal length of a mirror that forms an image 5.66 cm behind the mirror of an object placed at 34.4 cm in front of the mirror. Is the mirror concave or convex? (5)

Ans Distance of Object = p = 34.4 cm

Distance of Image = q = –5 cm

Focal Length = f = ?

By Mirror Formula = $\frac{1}{f} = \frac{1}{p} + \frac{1}{q}$

By putting values:

$$\frac{1}{f} = \frac{1}{34.4} + \frac{1}{-5.66}$$

$$= \frac{1}{34.4} - \frac{1}{5.66}$$

$$= \frac{5.66 - 34.4}{(34.4)(5.66)}$$

$$\frac{1}{f} = \frac{-28.74}{194.7}$$

$$f = -\frac{1947}{28.74}$$

$$f = -6.77 \text{ cm}$$

Minus value shows that it is convex mirror.

Q.6.(a) State Joule's law and derive its mathematical formula. (4)

Ans **Joule's Law:**

The amount of heat generated in a resistance due to flow of charges is equal to the product of square of current I, resistance R and the time duration t.

This energy can be utilized for different useful purposes. For example, bulb converts this energy into light and heat, heater and iron into heat, and fans into mechanical energy. Usually, this energy appears as heat in the resistance. This is the reason that we get heat when current passes through a heater.

Derivation of Mathematical Formula:

Consider two points with a potential difference of V volts. If one coulomb of charge passes between these points, the amount of energy delivered by the charge would be V joule. Hence, when Q coulomb of charge flows between these two points, then we will get QV joules of energy. If we represent this energy by W, then

Electrical energy supplied by Q charge $W = QV$ joules

Now current, when charges Q flow in time t, is defined as:

$$I = \frac{Q}{t}$$

or $$Q = I\,t$$

So the energy supplied by Q charge in t seconds =

$$W = V \times I \times t$$

This electrical energy can be converted into heat and other forms in the circuit.

From Ohm's law, we have $V = I\,R$

So the energy supplied by Q charge is,

$$W = I^2 R t = \frac{V^2 t}{R}$$

This equation is called Joule's law.

(b) Two charges repel each other with a force of 0.1 N when they are 5 cm apart. Find the force between the same charges when they are 2 cm apart. (5)

Ans Force of Repel = F = 0.1 N

Charges q_1 and q_2 = r = 5 cm

= 0.05 m

When:

r = 2 cm = 0.02 m

Then, to find force: F = ?

According to Coulomb's Law:

$$F = k = \frac{q_1 q_2}{r^2} \quad (1)$$

Here, $k = 9 \times 10^9 \text{ N m}^2 \text{ C}^{-2}$

By arranging for charges,

$$q_1 q_2 = \frac{r^2 F}{k} \quad (2)$$

Bu putting the values,

$$q_1 q_2 = \frac{0.1 \times (0.05)^2}{9 \times 10^9}$$

$$q_1 q_2 = \frac{1 \times 25}{9} \times 10^{-9-4-1}$$

$$= 2.8 \times 10^{-14} \text{ C}^2$$

Now, to find force:

$$F = \frac{k q_1 q_2}{r^2}$$

$$= (9 \times 10^9) \times \frac{2.8 \times 10^{-14}}{(0.02)^2}$$

$$= \frac{9 \times 2.8}{4} \times 10^{-1}$$

F = 0.63 N

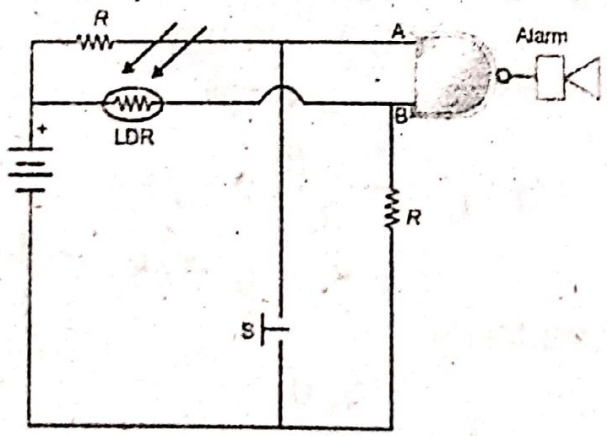
Q.7.(a) Explain the use of logic gates as safety alarm. (4)

Ans **Uses of Logic Gates:**

We can use logic gates in electronic circuits to do useful tasks. These circuits usually use light depending resistors (LDRs) to keep inputs LOW. An LDR can act as a switch that is closed when illuminated by light and open in the dark.

House Safety Alarm:

We can use single NAND gate to make burglar alarm. This can be done by using NAND gate, an LDR, a push-button switch S and an alarm. Connect LDR between NAND gate input B and the positive terminal of the battery. The LDR will cause a HIGH level input '1' at B when in light because of its Low resistance. The LDR will cause a Low level input '0' at B when light is interrupted and causes high resistance in LDR. A LOW level signal is also caused at A when burglar steps on switch S. So this burglar alarm sounds when either burglar interrupts light falling on LDR or steps on switch S.



(b) Cobalt-60 is radioactive element with half-life of 5.25 years. What fraction of the original sample will be left after 26 years? (5)

Ans For Answer see Paper 2017 (Group-I), Q.7.(b).