

# CLASS XII

## GUESS PAPER-042

### PHYSICS

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Time Allowed : 3 Hours

Max. Marks:70

General instruction:

1. All questions are compulsory. There are 26 questions in all.
2. This question paper has five sections: section A, section **B**, section C, section D and section E.
3. Section A contains five question of one mark each. Section B contains five questions of two marks each. Section C contains twelve questions of three marks each. Section D contains one value based question of four marks and section E contains three questions of five marks each.
4. There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all the three question of five marks weightage. You have to attempt only one of the choices in such question.
5. You may use the following values of physical constant wherever necessary.

$$c = 3 \times 10^8 \text{ m/s}$$

$$h = 6.63 \times 10^{-34} \text{ Js}$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

$$\mu_0 = 4\pi \times 10^{-7} \text{ TmA}^{-1}$$

$$\frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ Nm}^2\text{C}^{-2}$$

$$m_e = 9.1 \times 10^{-31} \text{ kg}$$

$$\text{Mass of the Neutron} = 1.675 \times 10^{-27} \text{ kg}$$

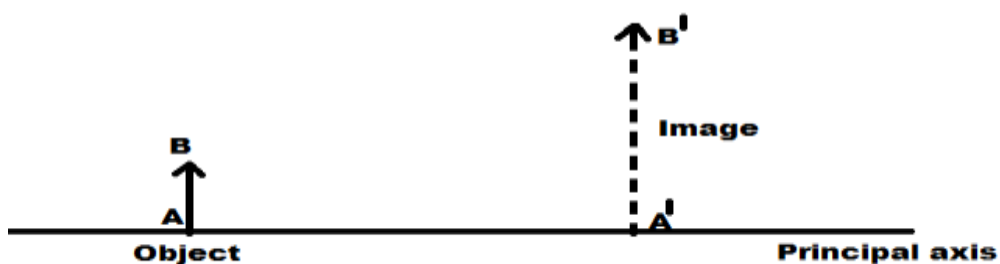
$$\text{Mass of the Proton} = 1.673 \times 10^{-27} \text{ kg}$$

Avogadro's number =  $6.023 \times 10^{23}$  per gram mole

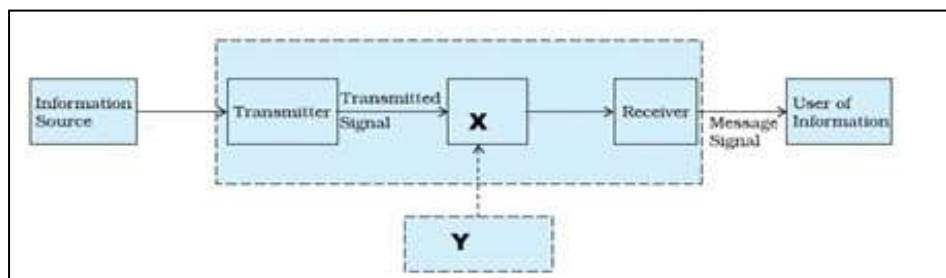
Boltzmann constant =  $1.38 \times 10^{-23} \text{JK}^{-1}$

## SECTION A

- Name the colours corresponding to the digits 3 and 6 in the colour code scheme for carbon resistors. (1)
- Redraw the diagram given below and mark the position of the center of curvature of the spherical mirror used in the given setup. (1)

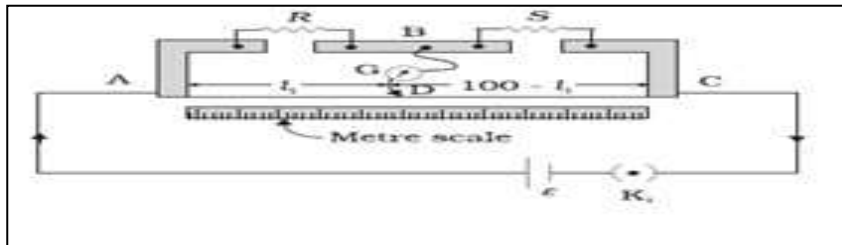


- You are given a capacitor and inductor, in this which one allows high frequency AC voltage. Give reason. (1)
- Faraday entered a big metallic cage supported on insulating pillars and then charged the cage by a powerful electric machine. He remained quite safe inside the cage. Do you believe on this happening? (1)
- Communication is the process of transmitting a message signal to the receiver. Figure shows the block diagram of communication system. Identify the box X and Y. write the function of transmitter. (1)



## SECTION B

6.



(a). In a meter bridge, The balance point is found to be at 39.5cm from the end A, when the resistor R is 12.5 ohm. Determine the resistance S. Why are the connections between resistors in a meter bridge made of thick copper strip?

(b). Determine the balance point of the bridge above is S and R are interchanged. (2)

7. Polarizer is a device which produces polarized light when an unpolarized light pass through it.

Analyzer is a device, that check whether the light coming from polarizer is polarized or not. Explain how the intensity of light from analyzer will vary when it moves from  $45^\circ$  to  $90^\circ$ . (2)

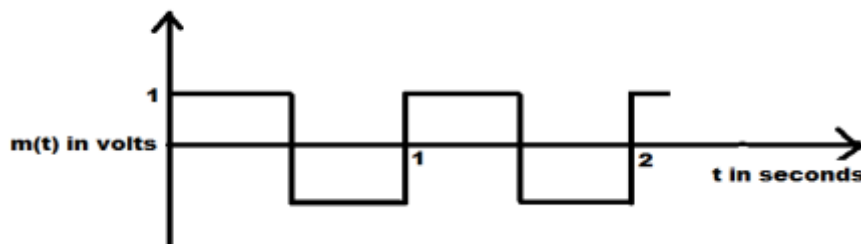
OR

Name the phenomenon which is responsible for bending of light around sharp corner of an obstacle. Under what condition does this phenomenon take place? Give one application in everyday life. (2)

8. In an experiments on photo electric effect, the slope of the cut off voltage versus frequency of incident light is found to be  $4.12 \times 10^{-15}$  V s. calculate the value of Planck's constant. (2)

9. The ground state energy of hydrogen atom is -13.6 eV. What are the kinetic and potential energies of the electron in this state? (2)

10. A modulated signal is a square wave, as shown in figure



The carrier is given by  $c(t) = 2 \sin(8\pi t)$  volts.

- (a) What is the modulation index? (2)
- (b) Sketch the amplitude modulated waveform.

### SECTION C

11. 27 drops of same size are charged at 220V each. All these drops combine to form a single bigger drop. Calculate the potential of bigger drop. (3)

(Assume no wastage of any kind and take the capacitance of a sphere of radius  $r$  as proportional to  $C$ .)

12. Moving coil galvanometer is a device used for detection and measurement of small amount of current. It's working based on the fact that when a current carrying coil is placed in a magnetic field, it experiences a torque.

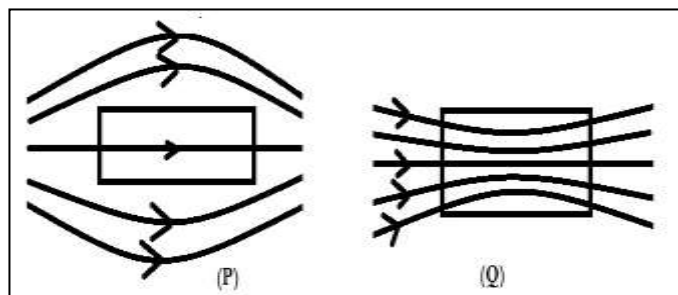
A galvanometer of resistance  $G$ ,  $n$  is the number of scale division in the galvanometer and  $K$  is the figure of merit of galvanometer. For converting this galvanometer to ammeter, a low resistance is connecting parallel with galvanometer. Obtain an expression for finding the value of this low resistance with the help of diagram. (3)

13. When a charged particle moves perpendicular to both electric and magnetic a force will experience.

- (a) State the underlying principle of cyclotron.
- (b) show that cyclotron frequency is independent of energy of the particle? Is there an upper limit on the energy acquired by the particle? Give reason.

OR

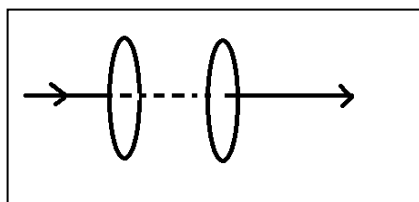
From the figure shown below,



- (a) Identify the material P and Q.  
 (b) how the magnetic properties P and Q vary with temperature T.  
 (c) Write the important properties of material P. (3)

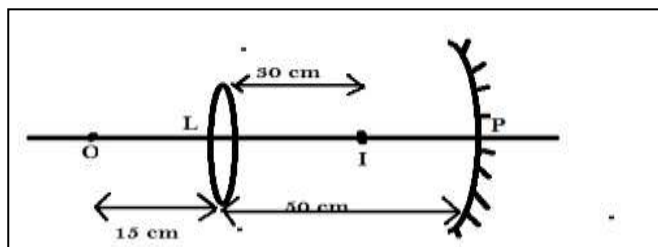
14. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuit in which  $R = 3\Omega$ ,  $L = 25.48 \text{ mH}$ ,  $C = 796\mu\text{F}$ . Find (i) the impedance of the circuit (ii) the phase difference between the voltage across the source and current (iii) The power dissipation in the circuit. (3)

15. Figure shows a capacitor made of two circular plate each of radius 12cm , and separated by 5.0cm . The capacitor is being charged by an external source (not shown in the figure). The charging current is constant and equal to 0.15 A.

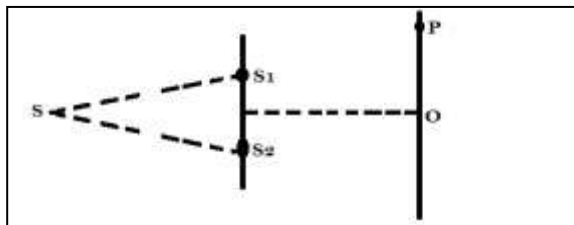


- (i) Calculate the capacitance and rate of change of potential difference between the plates.  
 (ii) Obtain the displacement current across the plate.  
 (iii) Is Kirchoff's first rule valid at each plate of the capacitor? Explain? (3)

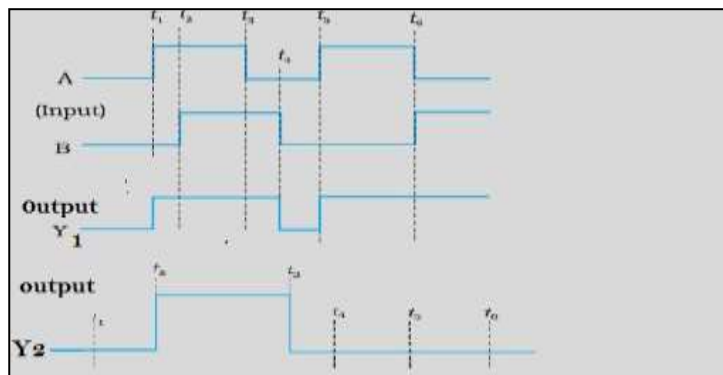
16. In the figure the direct image formed by the lens ( $f = 10\text{cm}$ ) of an object placed at O, and that formed after reflection from the spherical mirror are formed at same point O. What is the radius of curvature of mirror? (3)



17. Figure shows an experiment set up similar to Young's double slit experiment to observe interference of light. Here  $SS_2 - SS_1 = \lambda/4$ . Write down the condition of (i) constructive interference (ii) destructive interference at any point P in terms of path difference ( $S_2P - S_1P$ ). Does the central fringe observed in the above set up lie above or below O? Give reason.



18. (a) A radio isotopes has half life T years. How long will it take the activity to reduce to 1% of its original activity.
- (b) Two different radioactive elements with half lives  $T_1$  and  $T_2$  have  $N_1$  and  $N_2$  (undecayed) atoms respectively present at a given instant. Determine the ratio of their activities at this instant. (3)
19. A student has to use an appropriate number of (i) NAND gates (only) to get the output  $Y_1$  (ii) NOR gates (only) to get the output  $Y_2$ . From two given input A and B as shown in the diagram.



Identify the 'equivalent gate' needed in each case. Show how one can connect an appropriate number of (i) NAND (ii) NOR gates respectively in the two cases to get these ' equivalent gates' ..

20. Wave picture cannot be applied to this experiment. Sketch the graphs, showing the variation of stopping potential V with frequency  $\nu$  of the incident radiation for two photosensitive material A and B having threshold frequencies  $\nu_0 > \nu_0'$  respectively.
- (a) Which of the two metals A and B has higher work function?

- (b) What information do you get from the slope of the graphs?  
 (c) What does the value of the intercept of graph A on the potential axis represent? (3)

21. Demodulation is the process of retrieving the message signal from modulated signal. With the help of neat diagram explain the detection process of an amplitude modulated wave. (3)
22. Explain how (a) the zener diode works as voltage regulator. (b) Solar cell. (3)

### SECTION D

23. Muthuswami a resident of Kundakulam was all set to leave everything and shift to another place in view of the decision of Govt. to start nuclear thermal power plant at Kundakulam. His granddaughter Prachi, a science student, was really upset on the ignorant decision of her grandfather. She could finally convince him not to shift, since adequate safety measures to avoid any nuclear mishap have already been taken by the Govt. before starting nuclear thermal plants.
- What is the value displayed by Prachi in convincing her grandfather
  - What is the principle behind working of nuclear reactor?
  - What are the main components of nuclear reactor?
  - Why is heavy water used as moderator? (4)

### SECTION E

24. (a) state the theorem which relates total charge enclosed within a closed surface and the electric flux passing through it. Prove it for a single point charge.
- (b) A long charged cylinder of linear charge density  $\lambda$  is surrounded by a hollow co-axial conducting cylinder. What is the electric field in the space between two cylinders?

OR

A dipole is made up of two charges  $+q$  and  $-q$  separated by a distance  $2a$ .

Derive an expression for the electric field  $\vec{E}_e$  due to this dipole at a point distant  $r$  from the center of the dipole on the equatorial plane,

Draw the shape of the graph, between  $|\vec{E}_e|$  and  $r$  when  $r \gg a$ .

If this dipole were to be put in a uniform external electric field, obtain an expression for the torque acting on the dipole.

25. Draw a ray diagram to show the passage of a ray of light through a triangular prism. Use this diagram to obtain the relation for the refractive index of the material of the prism in terms of the angle of minimum deviation and the angle of the prism. Plot the nature of the graph for the angle of deviation versus the angle of incidence in a prism. (5)

**OR**

(a) Define a wavefront.

Given the shape of a wavefront as a plane wave at time  $t = 0$ , show using Huygens' construction,

(i) how the envelopes of secondary wavelets produce the plane wave at a later time  $t$  and (ii) how the emergent wavefront becomes spherical and converges to the focus after passing through a convex lens ?

(b) Verify using Huygens' Principle, Snell's law of refraction of a plane wave propagating from a denser to a rarer medium. (5)

26. (a) A simple A C generator having a constant magnetic field is connected to a resistive load. Mention the reason for the effect of doubling the speed of rotation on the following.  
(a) Frequency of rotation (b) the generated emf.  
(b) Obtain the frequency of a series L C circuit at resonance.  
(c) A person while walking through the doorway of a metal detector, it emits a sound. What does it indicate? What is the underlying principle of metal detector? (5)

**OR**

- (a) Show diagrammatically two different arrangements used for winding the primary and secondary coils in a transformer.  
(b) Assuming the transformer to be an ideal one, write the expressions for the ratio of its output voltage to input voltage.  
(c) The core of transformer is made of magnetic material. Give any two properties of such materials used.  
(d) Write any four types of energy losses in transformer. (5)

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