

Roll Number

Code Number 42/3



**INDIAN SCHOOL MUSCAT
THIRD PRELIMINARY EXAMINATION
PHYSICS**

CLASS: XII

Sub. Code: 042

Time Allotted: 3 Hrs

04.02.2018

SET 3

Max. Marks: 70

General Instructions:

- All questions are compulsory. There are 26 questions in all.**
- This question paper has five sections: Section A , Section B , Section C , Section D , and Section E.**
- Section A contains five questions 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.**
- 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 questions of five marks weightage. You have to attempt only one of choices in such questions.**
- You may use the following values of physical constants wherever necessary.**

$$c = 3 \times 10^8 \text{ m/s} , \quad h = 6.63 \times 10^{-34} \text{ Js} , \quad e = 1.6 \times 10^{-19} \text{ C} , \quad \mu_0 = 4\pi \times 10^{-7} \text{ T m A}^{-1}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2} , \quad \frac{1}{4\pi\epsilon_0} = 9 \times 10^9 \text{ N m}^2 \text{ C}^{-2} , \quad m_e = 9.1 \times 10^{-31} \text{ kg}$$

SECTION- A

- Define intensity of radiation on the basis of photon. 1
- A ray of monochromatic light passes from medium (1) to medium (2). If the angle of incidence in medium (1) is θ and corresponding angle of refraction in medium (2) is $\theta/2$, which of the two media is optically denser? Give reason. $1/2 , 1/2$
- An electromagnetic wave exerts pressure on the surface on which it is incident. Justify. 1
- A metallic piece gets hot when surrounded by a coil carrying high frequency alternating current. Why? 1
- Define the term ‘Mobility’ of charge carriers in conductor. Write its SI unit. $1/2 , 1/2$

SECTION- B

- (a) Write the necessary conditions for the phenomena of total internal reflection to occur.
(b) Write the relation between the refractive index and critical angle for given pair of optical Media 2
- Draw a graph showing the variation of potential energy between a pair of nucleons as a function of their separation. Indicate the regions in which the nuclear force is (a) attractive, (b) repulsive. Write two important conclusions which you can draw regarding the nature of the nuclear forces. 2

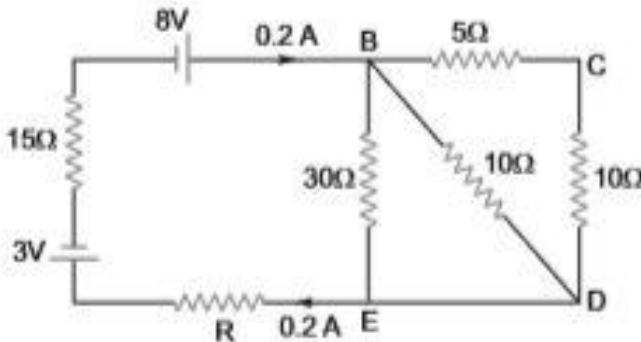
OR

Define the term 'Activity' of a radioactive substance. State its SI unit. Give a plot of activity of a radioactive species versus time.

8. A capacitor, made of two parallel plates each of plate area **A** and separation **d**, is being charged by an external ac source. Show that the displacement current inside the capacitor is same as the current charging the capacitor. 2
9. (a) Write two characteristics of a material used for making permanent magnets. 2
 (b) Why is core of an electromagnet made of ferromagnetic materials?
10. Using the concept of force between two infinitely long parallel current carrying conductors, define one ampere of current. 2

SECTION-C

11. Calculate the value of the resistance **R** in the circuit shown in the figure so that the current in circuit is **0.2 A**. What would be the potential difference between points **B** and **E**. 3



12. Define modulation index. Give its physical significance. For an amplitude modulated wave, the maximum amplitude is found to be **10V** while the minimum amplitude is **2V**. Determine the modulation index. 3

OR

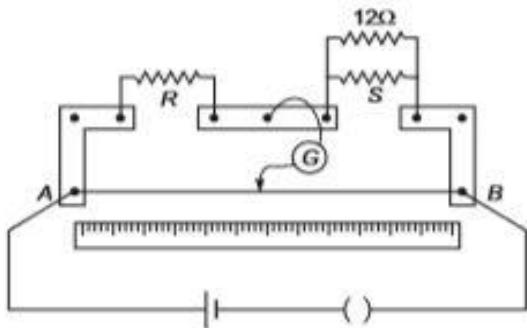
Write three important factors which justify the need of modulating a message signal. Show diagrammatically how an amplitude modulated wave is obtained when a modulating signal superimposed on a carrier wave

13. (a) What type of extrinsic semiconductor is formed when
 (i) germanium is doped with indium?
 (ii) silicon is doped with bismuth? 3
 (b) Draw energy band diagram of n-type and p-type semiconductors at temperature **T > 0K**.
 Mark the donor and acceptor energy levels with their energies.
14. (a) Monochromatic light of frequency **6.0×10^{14} Hz** is produced by a laser. The power emitted is **2.0×10^{-3} W**. Estimate the number of photons emitted per second on an average by source. 3
 (b) Draw a plot showing the variation of photoelectric current versus the intensity of incident radiation on a photosensitive surface.
15. (a) Draw a ray diagram for formation of image of a point by a thin double convex lens having radii of curvature **R₁** and **R₂**. Hence, derive lens maker's formula for a double convex lens. 3
 (b) A converging lens has a focal length of **20 cm** in air. It is made of a material of refractive index 1.5. If it is immersed in water of refractive index **4/3**, what will be new focal length?

16. Figure shows a rectangular conducting loop **PQRS** in which arm **RS** of length l is movable. The loop is kept in a uniform magnetic field **B** directed downward perpendicular to the plane of the loop. The arm **RS** is moved with a uniform speed **v**. Deduce an expression for
 (i) the emf induced across the arm **RS**
 (ii) the external force required to move the arm and
 (iii) the power dissipated as heat.



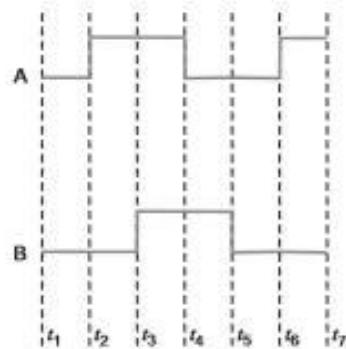
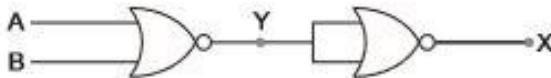
17. In a meter bridge, the null point is found at a distance 40 cm from **A**. If a resistance of 12Ω is connected in parallel with **S**, the null points occurs at 50 cm from **A**. Determine the value of **R** and **S**.



18. Describe briefly, by drawing suitable diagram, the (i) sky wave and (ii) space wave modes of propagation. Mention the frequency range of the waves in these modes of propagation.

19. (a) In a transistor, doping level in base is increased slightly. How will it affect (i) base current and (ii) collector current.

- (b) Draw the output waveform at **X**, using the given inputs **A** and **B** for the logic circuit shown below. Also, identify the logic operation performed by this circuit.



20. You are given three lenses **L₁**, **L₂** and **L₃** each of focal length 20 cm. An object is kept at 40 cm in front of **L₁**, as shown. The final real image is formed at the focus 'I' of **L₃**. Find the separations between **L₁**, **L₂** and **L₃**.

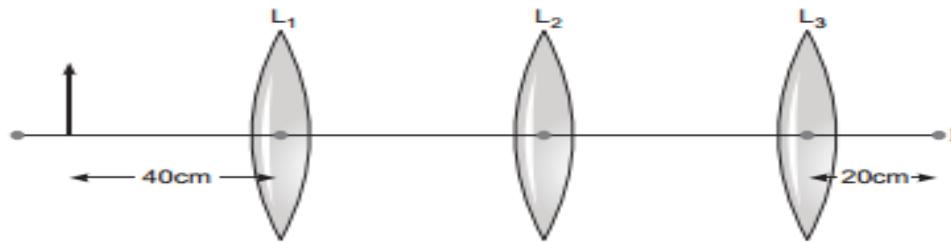
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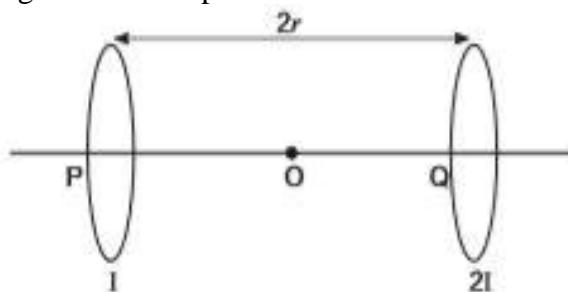
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21. Two identical circular loops, **P** and **Q** each of radius r and carrying currents I and $2I$ respectively 3 are lying in parallel planes such that they have a common axis. The direction of current in both the loops is clockwise as seen from **O** which is equidistance from both the loops. Find the magnitude of the net magnetic field at point **O**.



22. A parallel plate capacitor is charged by battery. After some time the battery is disconnected and a dielectric slab with its thickness equal to the plate separation is inserted between the plates. How will (i) the capacitance of the capacitor (ii) potential difference between the plates and (iii) the energy stored in the capacitor be affected? Justify your answer in each case. 3

SECTION- D

23. Ramaswami, a resident of Kudankulam, was all set to leave everything and shift to another place 4 in view of the decision of Government to start nuclear thermal power plant at Kudankulam. His granddaughter Manika, 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 Government before starting nuclear thermal plants.
- (a) Identify two values shown by Manika.
 (b) Name the working principle of nuclear reactor. Why is heavy water used as a moderator?

SECTION- E

24. An electric dipole is placed in a uniform electric field. 5
- (a) Show that no translatory force acts on it.
 (b) Derive an expression for the torque acting on it.
 (c) Find work done in rotating the dipole through 180° .

OR

- (a) Define electric flux. Write its SI unit.
- (b) Using Gauss's law, prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of the distance from it.
- (c) How is the field directed if (i) the sheet is positively charged, (ii) negatively charged?
25. (a) An a.c. Voltage $V = V_0 \sin \omega t$ is applied across a pure inductor of inductance L . Find an expression for the current I , flowing in circuit and show mathematically that the current flowing through it lags behind the applied voltage by a phase angle of $\pi/2$. Also draw phasor diagram. 5
- (b) Explain the term inductive reactance. Show graphically the variation of inductive reactance with frequency of applied alternating voltage.

OR

- (a) An a.c. Voltage $V = V_0 \sin \omega t$ is applied across a pure capacitor of capacitance C . Find an expression for the current I , flowing in circuit and show mathematically that the current flowing through it leads the applied voltage by a phase angle of $\pi/2$. Also draw phasor diagram.
- (b) Explain the term capacitive reactance. Show graphically the variation of capacitive reactance with frequency of applied alternating voltage.
26. (a) Draw a ray diagram to show refraction of ray of monochromatic light passing through a glass prism. Deduce the expression for the refractive index of glass in terms of angle of prism and angle of minimum deviation. 5
- (b) Explain briefly how the phenomenon of total internal reflection is used in fiber optics.

OR

- (a) What are coherent sources of light? Write two conditions for sustained interference pattern.
- (b) Derive a mathematical expression for the width of interference fringes obtained in Young's double slit experiment with the help of a suitable diagram.

End of the Question Paper