Roll Number **SET C**

INDIAN SCHOOL MUSCAT
FINAL TERM EXAMINATION
PHYSICS

CLASS: XII Sub. Code: 042 Time Allotted: 3 Hrs

19.11.2018 Max. Marks: 70

General Instructions:

1. All questions are compulsory. There are 27 questions in all.
2. This question paper has five sections: Section A, Section B, Section C and Section D.
3. Section A contains five questions of one mark each, Section B contains seven questions of two marks each, Section C contains twelve questions of three marks each and Section D contains three questions of five marks each.
4. There is no overall choice. However, an internal choice has been provided in two questions of one mark, two questions of two marks, four questions of three marks and three questions of five marks weightage. You have to attempt only one of choices in such questions.
5. You may use the following values of physical constants wherever necessary.

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

$\varepsilon_0 = 8.854 \times 10^{-12}\ C^2\ N^{-1} m^{-2}$, $1/4\pi\varepsilon_0 = 9 \times 10^{9}\ N\ m^2\ C^{-2}$, $m_e = 9.1 \times 10^{-31}$ kg

mass of neutron = 1.675×10^{-27} kg

mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

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

SECTION-A

1. The power factor of an AC circuit is **0.5**. What is the phase difference between voltage and current in this circuit? 1

2. Two nuclei have mass numbers in the ratio **1 : 2**. What is the ratio of their nucleus densities? 1

3. What type of wave front will emerge from a (i) point source and (ii) distant light source? 1

OR

State the essential condition for diffraction of light to take place.

4. Why does the sun look reddish at sun or sunrise? 1

5. If the maximum kinetic energy of electrons emitted in photo-cell is **5ev**, what is the stopping potential? 1

OR

The stopping potential in an experiment on photoelectric is **1.5 V**. What is maximum kinetic energy of the photoelectrons emitted?

SECTION-B

6. 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.

7. Derive an expression for drift velocity of free electrons in a conductor in terms of relaxation time. 2

OR

Plot a graph showing temperature dependence of resistivity for a typical semiconductor. How is this behavior explained?

8. A thin straight infinitely long wire having charge density λ is enclosed by a cylindrical surface of radius **r** and length l , its axis coinciding with the length of the wire. Find the expression for the electric flux through the surface of the cylinder. 2

9. Identify the electromagnetic waves whose wavelength vary as 2

(i) $10^{-12}\ m < \lambda < 10^{-8}\ m$

(ii) $10^{-3}\ m < \lambda < 10^{-1}\ m$

Write one use for each.

10. Show that the radius of the orbit in hydrogen atom varies as n^2, where **n** is the principal quantum number of the atom. 2

11. A potential difference **V** is applied across the ends of copper wire of length l and diameter **D**. what is the effect on drift velocity of electrons if 2

(i) **V** is halved (ii) l is doubled

12. Derive the expression for the electric potential due to an electric dipole at a point on its axial line. 2

SECTION-C

13. Calculate the amount of work done to dissociate a system three charges, two of **+1μC** and one of **-4μC** placed on the vertices of an equilateral triangle of side **10** cm. 3

OR

A **600** pF capacitor is charged by a **200** V supply. It is then disconnected from the supply and is connected to another uncharged **600** pF capacitor. How much electrostatic energy is lost in the process?

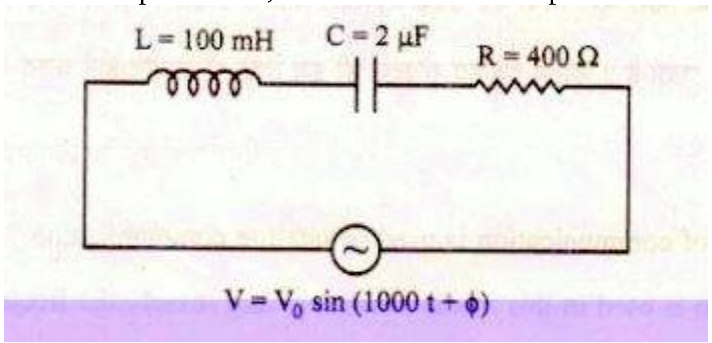
14. Distinguish between diamagnetic and ferromagnetic materials in respect of their (i) intensity of magnetization (ii) behavior in non-uniform magnetic field and (iii) susceptibility. 3

15. Draw the graph showing the variation of binding per nucleon with the mass number for a large number of nuclei **2 < A < 240** . What are the main inferences from the graph? 3

16. Using Huygens' principle, draw a diagram showing how a plane wavefront gets refracted, when it is incident on the surface separating a rarer medium from a denser medium? Hence , verify Snell's laws of refraction. 3

17. (i) Find the value of the phase difference between the current and the voltage in the series LCR circuit shown below. Which one leads in phase: current or voltage? 3

(ii) Without making any other change , find the value of the additional capacitor , $\mathbf{C_1}$, to be connected in parallel with the capacitor **C** , in order to make the power factor of the circuit unity.

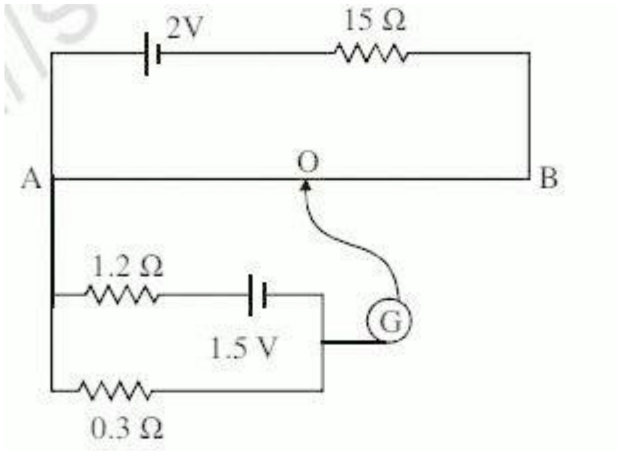


18. State the working of ac generator with the help of a labeled diagram. The coil of an ac generator having **N** turns, each of area **A**, is rotated with constant angular velocity **ω**. Deduce the expression for the alternating emf generated in the coil. 3

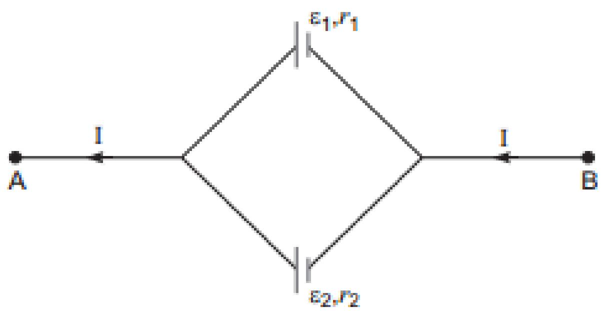
OR

Draw a schematic diagram of a step-up transformer. Explain its working. Deduce the expression for the secondary to primary voltage in terms of the number of turns in the two coils

19. In the following potentiometer circuit **AB** is a uniform wire of length **1 m** and resistance **10Ω**. Calculate the potential gradient along the wire and balance length **AO.** 3



20. Two cells of emfs E_1 and E_2 having internal resistances r_1 and r_2 respectively are connected in parallel as shown. Deduce the expressions for the equivalent emf and equivalent internal resistance of a cell which can replace the combination between the points **A** and **B** . 3



21. Define the terms threshold frequency and stopping potential in the study of photoelectric emission. Explain briefly the reasons why wave theory of light is not able to explain the observed features in photoelectric effect? 3

OR

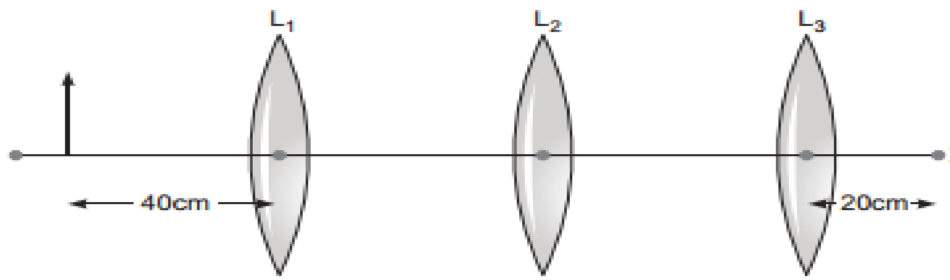
Derive an expression for the de-Broglie wavelength associated with electron accelerated through a potential **V**. Show graphically, the variation of de-Broglie wavelength (λ) with potential(**V**).

22. Draw a ray diagram for formation of image of a point object by a thin double convex lens having radii of curvature R_1 and R_2 . Hence, derive lens maker's formula for a double convex lens. 3

OR

Describe briefly how a diffraction pattern is obtained on a screen due to a single narrow slit illuminated by a monochromatic source of light. Hence, obtain the conditions for secondary minima.

23. You are given three lenses **L_1 , L_2** and **L_3** each of focal length **20** cm. An object is kept at **40** cm in front of **L_1**, as shown. The final real image is formed at the focus **'I'** of **L_3**. Find the separations between **L_1 , L_2** and **L_3**. 3



24. (i) Write two properties of a material suitable for making an electromagnet. 3

(ii) At a place, the horizontal component of earth's magnetic field is **B** and angle of dip is **60^0.**

What is the value of horizontal component of earth's magnetic field at equator?

SECTION-D

25. a) Explain briefly how the phenomenon of total internal reflection is used in fiber optics. 5

(b) 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.

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.

26. Define electric dipole moment. What is its SI unit? Find the expressions for the force and torque on an electric dipole kept in a uniform electric field. 5

OR

Derive an expression for the energy stored in a parallel plate capacitor **C**, charged to a potential difference **V**. Hence derive an expression for the energy density of a capacitor.

27. (i) 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

(ii) Explain the term inductive reactance. Show graphically the variation of inductive reactance with frequency of applied alternating voltage.

OR

(i)An a.c. Voltage $\mathbf{V = V_0 \sin \omega t}$ 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 $\boldsymbol{\pi/2}$. Also draw phasor diagram.

(ii) Explain the term capacitive reactance. Show graphically the variation of capacitive reactance with frequency of applied alternating voltage.

End of the Question Paper