SAVITRIBAI PHULE PUNE UNIVERSITY

Progressive Education Society's
Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-411016

B.Sc. Blended Program
(A degree of Savitribai Phule Pune University equivalent to the degree of University of Melbourne)
End Semester Examination: April- 2024

Program: B.Sc. Blended **Program (Specific):** B.Sc. Blended (Chemistry) **Set: B**
Class: S.Y.B. Sc. Blended   **Semester: II**
Course code: PHY402
Course name: Electricity, Magnetism and Optics
Credits: 3   **Time: 2½ hours**   **Maximum marks: 50**

Instructions to the candidate:
- All questions are compulsory.
- Figures to the right indicate marks.
- Draw diagrams wherever necessary.
- Use of scientific calculator is allowed.
- Ask for graph paper if needed.

Q1] Select the correct option   (Any 10/12)   **[10]**

1) If two charges +2µC and +4 µC are separated by 100cm from each other, the force on charge +4 µC is _____.

   A) greater than force on +2µC   B) equal to force on +2µC
   C) less than force on +2µC   D) None of these

2) _____ is the example of non- polar molecule

   A) HCl   B) H_2O C) CO   D) CO_2

3) The S.I unit of magnetic susceptibility is _____.

   A) C/m^2 B) Weber $/m^2$ C) no unit   D) Tesla

4) $\oint B \cdot dl = \mu_0 I$ is the mathematical expression of _____ .

   A) Faraday's law   B) Lenz's law
   C) Ampere's circuital law   D) Gauss's law in electrostatics

5) Relation between Tesla and Gauss is

   A) $1T = 10^{-4} G$ B) $1T = 10^4 G$ C) $1T = 10^2 G$ D) $1T = 10^{-2} G$

6) The S.I unit of Inductance is _____.

   A) Farad   B) Henry   C) Weber   D) A-m

7) Relation for relativistic mass is given by_____

   A) $m = \dfrac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$ B) $m_0 = \dfrac{m}{\sqrt{1-\frac{v^2}{c^2}}}$ C) $m_0 = \dfrac{m^2}{\sqrt{1-\frac{v^2}{c^2}}}$ D) $m^2 = \dfrac{m_0}{\sqrt{1-\frac{v^2}{c^2}}}$

8) Speed of light in Km/s is_____

   A) 3×10^8 B) 3×10^{11} C) 3×10^5 D) 3×10^{10}

9) When dielectric is inserted between plates capacitance

   A) Increases   B) Decreases   C) Remains constant   D) None of these

10) If an object reaches the speed of light, its length changes to _____
   A) Infinite   B) Zero   C) Half the value   D) Double the value

11) When light passes from rarer medium to denser medium, its velocity_____
   A) increases   B) decreases   C) remains constant   D) becomes double

12) Clocks in a moving reference frame, compared to identical clocks in a stationary reference frame, appears to run_____
   A) Slower   B)Faster   C) At same rate   D)Backward in time

Q2] Answers of following or solve problems. (Any 10/12)   [20]

1) Define magnetic field.
2) Calculate the force between two balls each having a charge of 24 n C and kept 10 cm apart. (Given- $1/4\pi\varepsilon_0 = 9 \times 10^9$ N.m^2/C^2)
3) State Coulomb's law.
4) Give the physical significance of equation of continuity.
5) Define electric potential.
6) What are non- polar molecules?
7) A beam of monochromatic light of wavelength 5.89×10^{-7} m is incident normally on a thin wedge shaped film of air of refractive index 1. Calculate the thickness of the film where 8th dark fringe is formed in the reflected system.
8) Explain the physical significance of $E = mc^2$.
9) If the diameter of the nth dark ring in Newton's Rings experiment changes from 0.30 cm to 0.25 cm when air is replaced by a transparent liquid, find the refractive index of liquid?
10) A proton moves at a speed of 0.95c. Calculate total energy. (Given: Mass of Proton is 1.67×10^{-27})
11) What are the applications of Newton's Rings experiment?
12) What are inertial and non- inertial frame of reference?

Q3] Answers of following or solve problems. (Any 4/6)   [20]

1) Obtain an expression for magnetic field due to circular current loop.
2) Write a short note on electric polarization of dielectric.
3) The parallel-plate capacitor of plate area 0.01m^2 is filled with dielectric of dielectric constant 5. Its capacitance is 2×10^{-10} F and it has been charged to 50 v. Find electric field intensity in dielectric. (Given- $\varepsilon_0 = 8.85 \times 10^{-12}$ C^2/Nm^2)
4) A proton is projected with speed of 3×10^6 m/s horizontally from east to west. A uniform magnetic field of strength 4×10^{-3} T exists in vertically upward direction. Find the force on proton just after its projection. Also calculate the acceleration produced. (Given- mass of proton = 1.67×10^{-27} kg and charge = 1.6×10^{-19}C)
5) Derive the relation for time dilation and explain twin paradox.
6) Newton's rings are formed between plane glass plate and plano-convex lens of radius 60 cm. If diameter of 3rd bright ring is 0.0018 m and that of 23rd bright ring is 0.005 m, calculate wavelength of light.

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