Tamilnadu Board Class 12 Physics Previous year
Question Paper March 2016

PART - III

இயற்கையியல் / PHYSICS

(தமிழ் மற்றும் அஞ்சனை விளக்கி / Tamil & English Versions)

தேர்வு : 3 பாகங்கள்

Time Allowed : 3 Hours

[Maximum Marks : 150]

Instructions:

(1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.

(2) Use Black or Blue ink to write and pencil to draw diagrams.

30x1=30

தமிழ்:

(i) அலங்காரம் விளக்கற்று விளக்கிக் குறிக்கவும்.

(ii) கிபார விளங்கும் சிலராகத் தோற்றுவிக்கவும்.

Note:

(i) Answer all the questions.

(ii) Choose and write the correct answer.
1. \( A(A + B) = ? \)
   (a) \( A \)  \( \) (b) \( B \)  \( \) (c) \( AB \)  \( \) (d) \( A + B \)

2. The radio isotope used in agriculture is:
   (a) \( _{15}^{31}P \)  \( \) (b) \( _{15}^{32}P \)  \( \) (c) \( _{11}^{23}Na \)  \( \) (d) \( _{11}^{24}Na \)

3. The nuclear radius of \( _4Be \) nucleus is:
   (a) \( 1.3 \times 10^{-15} \text{ m} \)  \( \) (b) \( 2.6 \times 10^{-15} \text{ m} \)  \( \) (c) \( 1.3 \times 10^{-13} \text{ m} \)  \( \) (d) \( 2.6 \times 10^{-13} \text{ m} \)

4. A ray of light travelling in air is incident on a denser surface at an angle of 60°. If the velocity of light in the denser medium is \( 2 \times 10^8 \text{ ms}^{-1} \), the angle of refraction inside the denser medium is:
   (a) \( 30° \)  \( \) (b) \( \sin^{-1}(0.75) \)  \( \) (c) \( \sin^{-1}\left(\frac{1}{\sqrt{3}}\right) \)  \( \) (d) \( \sin^{-1}(0.6666) \)
5. \( \text{N}^{13} \) has a half life of 10.1 minutes. Its mean life time is:

(a) 5.05 minutes  
(b) 20.2 minutes  
(c) \( \frac{10.1}{0.6931} \) minutes  
(d) infinity

The half life period of \( \text{N}^{13} \) is 10.1 minute. Its mean life time is:

(a) 5.05 minutes  
(b) 20.2 minutes  
(c) \( \frac{10.1}{0.6931} \) minutes  
(d) infinity

6. In electromagnetic waves, the waves are:

(a) circularly polarised  
(b) plane polarised  
(c) linearly polarised  
(d) helical polarised

In amplitude modulation, the bandwidth is:

(a) equal to the signal frequency  
(b) twice the signal frequency  
(c) thrice the signal frequency  
(d) four times the signal frequency

7. A beam of cathode rays moves from left to right in a plane of the paper and it enters into a uniform magnetic field acting perpendicular to the plane of the paper and inwards. Now, the cathode rays are deflected:

(a) downwards  
(b) upwards  
(c) in a direction perpendicular to the plane of the paper and inwards  
(d) in a direction perpendicular to the plane of the paper and outwards

[ Turn over ]
8. Electromagnetic induction is not used in:
(a) transformer (b) room heater
(c) AC generator (d) choke coil

9. A wire of length 1 m is made into a circular loop and it carries a current of 3.14 A. The magnetic dipole moment of the current loop (in Am$^2$) is:
(a) 1 (b) 0.5 (c) 0.25 (d) 0.314

10. When a dielectric slab is introduced between the plates of a charged parallel plate capacitor, its:
(a) potential increases 
(b) electric field decreases 
(c) charge increases 
(d) capacitance decreases
11. Calculate the voltage at B in the figure:

+6 V
(B) 2 kΩ

(Ş) 5.3 V  (ş) 5.7 V  (ç) 6.3 V  (ř) 6 V

+6 V
(Germanium diode)

B
2 kΩ

The voltage at B in the figure is
(a) 5.3 V  (b) 5.7 V  (c) 6.3 V  (d) 6 V

12. In an electromagnetic wave:

(a) power is equally transferred along the electric and magnetic fields
(b) power is transmitted in a direction perpendicular to both the fields
(c) power is transmitted along electric field
(d) power is transmitted along magnetic field

13. The length of the rod placed inside a rocket is measured as 1 m by an observer inside the rocket which is at rest. When the rocket moves with a speed of \(36 \times 10^6\) km/hr the length of the rod as measured by the same observer is:

(a) 0.997 m  (b) 1.003 m  (c) 1 m  (d) 1.006 m

The length of the rod placed inside a rocket is measured as 1 m by an observer inside the rocket which is at rest. When the rocket moves with a speed of \(36 \times 10^6\) km/hr the length of the rod as measured by the same observer is:

(a) 0.997 m  (b) 1.003 m  (c) 1 m  (d) 1.006 m

[ Turn over]
14. Avalanche breakdown (Avalanche breakdown) is primarily dependent on the phenomenon of:
(a) collision (b) ionisation (c) doping (d) recombination

15. Atomic spectrum should be:
(a) pure line spectrum (b) emission band spectrum (c) absorption line spectrum (d) absorption band spectrum

16. The chromium ions doped in the ruby rod:
(a) absorbs red light (b) absorbs green light (c) absorbs blue light (d) emits green light

17. A and B are two hollow metal spheres of radii 50 cm and 1 m carrying charges 0.6 μC and 1 μC respectively. They are connected externally by a conducting wire. Now the charge flows from:
(a) A to B till the charges become equal (b) A to B till the potentials become equal (c) B to A till the charges become equal (d) B to A till the potentials become equal
18. High frequency waves follow:
(a) the ground wave propagation  (b) the line of sight direction
(c) ionospheric propagation  (d) the curvature of the earth

19. X-ray is:
(a) phenomenon of conversion of kinetic energy into radiation  
(b) conversion of momentum
(c) conversion of energy into mass  
(d) principle of conservation of charge

20. The equipotential surface of an electric dipole is:
(a) a sphere whose centre coincides with the centre of the electric dipole
(b) a plane surface inclined at an angle of 45° with the axis of the electric dipole
(c) a plane surface passing through the centre of the electric dipole and perpendicular to the axis of the electric dipole
(d) any plane surface parallel to the axis of the electric dipole

21. The mass defect of a certain nucleus is found to be 0.03 amu. Its binding energy is:
(a) 27.93 eV  
(b) 27.93 keV  
(c) 27.93 MeV  
(d) 27.93 GeV
22. An ideal voltmeter has:
(a) zero resistance
(b) finite resistance less than $G$ but greater than zero
(c) resistance greater than $G$ but less than infinity
(d) infinite resistance

23. The instantaneous emf and current equations of an RLC series circuit are
$$e = 200 \sin \left( \omega t - \frac{\pi}{6} \right)$$
$$i = 20 \sin \left( \omega t + \frac{\pi}{6} \right)$$

The average power consumed per cycle is
(a) zero (b) 2000 W (c) 1000 W (d) 500 W

24. The elliptical orbits of electron in the atom was proposed by:
(a) J.J. Thomson (b) Bohr (c) Sommerfeld (d) de Broglie
25. The unit of permittivity is
(a) $C^2 N^{-1} m^{-2}$  
(b) $Nm^2 C^{-2}$
(c) $Hm^{-1}$  
(d) $NC^2 m^{-2}$

26. In an electromagnetic wave, the phase difference between electric field $E$ and magnetic field $B$ is:
(a) $\frac{\pi}{4}$  
(b) $\frac{\pi}{2}$  
(c) $\pi$  
(d) zero

27. At the threshold frequency the velocity of the electrons is:
(a) zero  
(b) maximum  
(c) minimum  
(d) infinite

28. 1 Wh (Watt hour) is equal to:
(a) $36 \times 10^5$ J  
(b) $36 \times 10^4$ J  
(c) $3600$ J  
(d) $3600$ Js$^{-1}$

1 Wh (Watt hour) is equal to:
(a) $36 \times 10^5$ J  
(b) $36 \times 10^4$ J  
(c) $3600$ J  
(d) $3600$ Js$^{-1}$
29. A rectangular coil of wire is placed in a uniform magnetic field such that the plane of
the coil is parallel to the magnetic field. The magnetic flux linked with the coil and the
emf induced are respectively:
(a) zero and zero  (b) zero and maximum
(c) maximum and zero  (d) maximum and maximum

30. Lenz’s law is in accordance with the law of
(a) conservation of charges  (b) conservation of flux
(c) conservation of momentum  (d) conservation of energy

15x3=45

Note: Answer any fifteen questions.

31. State Gauss’s law in electrostatics.

32. Write any three properties of electric lines of force.

33. Define mobility. Give its unit.

34. A 10 Ω resistance is connected in series with a cell of emf 10 V. A voltmeter is connected
in parallel to a cell, and it reads 9.9 V. Find the internal resistance of the cell.
35. Define temperature coefficient of resistance.

36. A current of 10 A flows in a long straight wire placed in air. Calculate the magnetic induction at a point 10 cm from the wire.

37. What are the methods of producing induced emf?

38. An aircraft having a wingspan of 20.48 m flies due north at a speed of 40 ms⁻¹. If the vertical component of earth’s magnetic field at the place is 2 × 10⁻⁵ T, calculate the emf induced between the ends of the wings.

39. Distinguish between interference and diffraction.

40. Write any three uses of polaroids.

41. State Moseley’s law. Write its equation.
42. In Millikan’s experiment, an oil drop of mass $4.9 \times 10^{-14}$ kg is balanced by applying a potential difference of $9.8$ kV between the two plates which are $12.8$ mm apart. Calculate the number of elementary charges on the drop. (Take $g = 10$ ms$^{-2}$)

In Millikan’s experiment, an oil drop of mass $4.9 \times 10^{-14}$ kg is balanced by applying a potential difference of $9.8$ kV between the two plates which are $12.8$ mm apart. Calculate the number of elementary charges on the drop. (Take $g = 10$ ms$^{-2}$)

43. Write the uses of electron microscope.

44. What is β-decay? Give an example.

45. Write any three uses of nuclear reactor.

46. Draw the circuit diagram of a voltage regulator using zener diode.

47. When the negative feedback is applied to an amplifier of gain 50, the gain after feedback falls to 25. Calculate the feedback ratio.

48. What are universal gates? Why are they called so?

49. Write the advantages of Integrated Circuits (ICs).

50. What is skip distance?
13

Note:
(i) Answer question number 51 compulsorily.
(ii) Answer any six of the remaining 11 questions.
(iii) Draw diagrams wherever necessary.

51. The plates of a parallel plate capacitor have an area of 90 cm$^2$ each and are separated by 2.5 mm. The capacitor is charged by connecting it to a 400 V supply. How much electrostatic energy is stored by the capacitor?

OR

Three charges $+1 \mu C$, $+3 \mu C$ and $-5 \mu C$ are kept at the vertices of an equilateral triangle of sides 60 cm. Find the electrostatic potential energy of the system of charges.

52. Write any five applications of Superconductors.
54. Write the special features of Magnetic Lorentz force.

55. Obtain an expression for the current flowing in a circuit containing resistance only to which alternating emf is applied. Explain the phase relationship between voltage and current with a graph.

56. In Young’s double slit experiment two coherent sources of intensity ratio of 64 : 1 produce interference fringes. Calculate the ratio of maximum and minimum intensities.

57. Write any five properties of canal rays.

58. What is photoelectric effect? State the laws of photoelectric emission.

59. Explain time dilation with an example.
60. React with the given nuclear equation and determine the energy released.

\[ \text{\( ^3\text{Li}^6 + \text{n}^1 \rightarrow ^2\text{He}^4 + ^1\text{H}^3 \)} \]

Given:

- Mass of \( ^3\text{Li}^6 \) nucleus = 6.015126 amu
- Mass of \( ^1\text{H}^3 \) nucleus = 3.016049 amu
- Mass of \( ^2\text{He}^4 \) nucleus = 4.002604 amu
- Mass of \( \text{n}^1 \) = 1.008665 amu

Calculate the energy released in the following reaction.

\[ ^3\text{Li}^6 + \text{n}^1 \rightarrow ^2\text{He}^4 + ^1\text{H}^3 \]

Given:

- Mass of \( ^3\text{Li}^6 \) nucleus = 6.015126 amu
- Mass of \( ^1\text{H}^3 \) nucleus = 3.016049 amu
- Mass of \( ^2\text{He}^4 \) nucleus = 4.002604 amu
- Mass of \( \text{n}^1 \) = 1.008665 amu

61. Explain the working of a half wave diode rectifier.

62. What is an optical fiber? Write its advantages.

- **Math - IV/PART - IV**

**Instructions:**

(i) Answer any four questions.

(ii) Draw diagrams wherever necessary.

63. Derive an expression for electric field due to an electric dipole at a point on its axial line.
64. Explain with neat diagram the principle, construction and working of a cyclotron.

65. Explain in detail the principle, construction and working of a single phase AC generator.

66. Explain Raman effect with the help of energy level diagram.

67. Describe the J.J. Thomson method for determining the specific charge of an electron.

68. Explain the construction and working of a Bainbridge mass spectrometer. Mention its use.

69. What is an operational amplifier? Explain its working as a non-inverting amplifier.

70. With the functional block diagram explain the working of a monochrome TV transmitter.

---

o O o -