

2017
PHYSICS
(Theory)

Full Marks - 70

Pass Marks - 21

Time : Three Hours and *Fifteen Minutes

*(*15 minutes are given as extra time for reading questions)*

Attempt all questions.

The figures in the right margin indicate full marks for the questions.

Question Nos. 1 to 10 are 'Very Short Answer' type questions carrying 1 mark each.

1. State the principle of superposition of charges. 1
2. Why is manganin used for making standard resistors? 1
3. State Ampere's circuital law. 1
4. Define induced current. 1

5. What is an electromagnetic spectrum ? 1
6. Eye is more sensitive to yellow colour but danger signals are made with red colour. Why ? 1
7. Write Einstein's photoelectric equation. 1
8. Give *one* example of isobars. 1
9. Define a semiconductor in terms of energy bands in solid. 1
10. Why is it necessary to use satellite for long distance TV transmission ? 1

Questions Nos. 11 to 20 are 'Short Answer Type – II' questions carrying 2 marks each.

11. State Gauss's law in the integral form and write its equation. 2
12. Two wires P and Q of same diameter and same length are joined in parallel and the combination is connected across a battery. The resistance of P i.e. R_p is greater than resistance of Q i.e. R_q . Which wire will become hotter ? 2
13. What are primary functions of the electric field and magnetic field in a cyclotron ? 2

14. Why does not the energy of a charged particle moving in a uniform magnetic field change ? 2

15. Differentiate between a.c. and d.c. by giving *two* points. 2

16. Draw a common resonance curve for two resistances R_1 and R_2 ($R_1 > R_2$) in L-C-R series circuit at resonant frequency f_r for the same values of L and C. 2

17. The frequency of an electromagnetic wave is $1.5 \times 10^{18} \text{ Hz}$. Calculate wavelength in angstrom. 2

18. Draw a neat labelled ray diagram of a compound microscope in which the image of an object is formed at infinity. 2

19. Distinguish between a photon and an electron by giving *two* points. 2

20. Why is a nucleus more stable if it has large value of mass defect ? Explain. 2

Question Nos. 21 to 27 are 'Short Answer Type - I' questions carrying 3 marks each.

21. Show that the electric current in a wire is directly proportional to the drift velocity of electrons in that wire. 3

22. How will you convert a galvanometer having 100Ω resistance which requires 1 mA current for its full scale deflection into an ammeter to read upto 1 A ? 3

23. Prove that the average power absorbed by an inductor in an a.c. circuit is zero. 3
24. Differentiate between interference and diffraction of light by giving *three* points. 3
25. A convex lens made of a glass of refractive index $3/2$ has a focal length ' f ' in air. If it is immersed into water of refractive index $4/3$, then with calculation, predict the new focal length of the lens inside water. 3
26. How do the mass number and atomic number change in α -decay ? A nucleus X becomes nucleus Y as a result of α -decay. Represent it by an equation. 3
27. Name *any three* communication channels. 3

Question Nos. 28 to 30 are 'Long Answer Type' questions carrying 5 marks each.

28. What is a capacitor ? Derive an expression for capacitance of a parallel plate capacitor partly filled with a dielectric slab. 1+4=5

OR

In what form of field, is the energy of a capacitor stored ? Derive an expression for energy of a parallel plate capacitor. 1+4=5

29. Prove the laws of reflection using Huygens' principle. 5

OR

Prove the laws of refraction using Huygens' principle. 5

30. What is a rectifier? Discuss the working of PN junction diodes as a full wave rectifier. 1+4=5

OR

What is an amplifier? Discuss the working of a common emitter transistor (npn) as an amplifier. 1+4=5

Question Nos. 31 to 34 are 'Multiple Choice Type' questions carrying 1 mark each. Choose the correct answer out of the four alternatives and rewrite the correct answer.

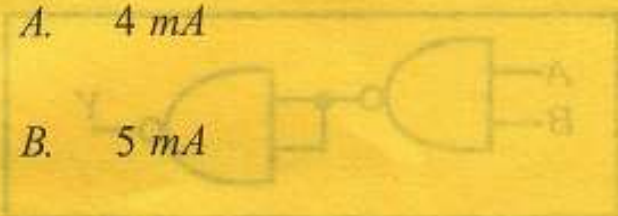
31. A charge of 10mC flows through a wire of cross section 2.5mm^2 normally in 2 seconds. The current is 1

A. 4 mA

B. 5 mA

C. 20 mA

D. 25 mA .



32. The de Broglie wavelength λ is related to kinetic energy (E) of a particle as

1

A. $\lambda \propto \sqrt{E}$

B. $\lambda \propto \frac{1}{\sqrt{E}}$

C. $\lambda \propto E$

D. $\lambda \propto \frac{1}{E}$

33. The combination of NAND gates shown in the figure gives

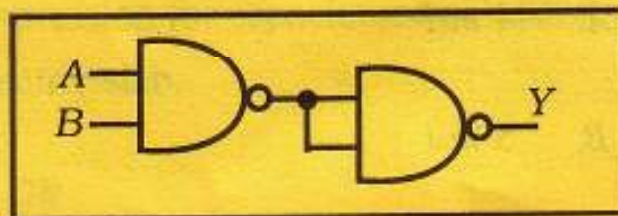
1

A. AND gate

B. OR gate

C. NOT gate

D. None of the above.



34. The radio waves can be sent from one place to another through

1

- A. Ground wave propagation.
- B. Sky wave propagation.
- C. Space wave propagation.
- D. All the above.