TVL12P

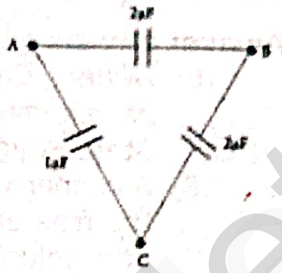
Tirunelveli District
Common Half Yearly Examination - 2024

Standard 12
PHYSICS
PART - I

Time: 3.00 Hours Marks: 70

Choose the best option from the following: 15×1=15

1) Three capacitors are connected in triangle as shown in the figure. The equivalent capacitance between the points A and C is



a) 1 μF b) 2 μF

c) 3 μF d) $\frac{1}{4}$ μF.

2) A dipole of dipole moment $\vec{p}$ is palced in uniform electric field $\vec{E}$, then torque acting on it is given by

a) $\vec{\tau} = \vec{P} \cdot \vec{E}$ b) $\vec{\tau} = \vec{E} \times \vec{P}$ c) $\vec{\tau} = \vec{P} \times \vec{E}$ d) $\vec{\tau} = \vec{P} + \vec{E}$

3) A toaster operating at 240 Vhas a resistance of 120Ω . The power is

a) 400 W b) 2 W c) 480 W d) 240 W

4) The force experienced by a particle having mass m and charge q accelerated through a potential difference V, when it is kept under perpendicular magnetic field $\vec{B}$ is,

a) $\sqrt{\frac{2q^3BV}{m}}$ b) $\sqrt{\frac{q^3B^2V}{2m}}$ c) $\sqrt{\frac{2q^3B^2V}{m}}$ d) $\sqrt{\frac{2q^3BV}{m^3}}$

5) A bar magnet of magnetic moment $\vec{M}$ is cut into two parts of equal length. The magnetic moment of each part will be

a) $\vec{M}$ b) $2\vec{M}$ c) zero d) 0.5 $\vec{M}$

6) Which of the following is an electromagnetic wave?

a) α-rays b) β-rays c) γ-rays d) all of them

7) A ray of light travelling in a transparent medium of refractive index n falls, on a surface seperating the medium from air at an angle of incidents of 45°, The ray can undergo total internal reflection for the following n,

a) n=1.25 b) n=1.33 c) n=1.4 d) n=1.5

8) In a series resonant RLC circuit, the Voltage across 100Ω resistor is 40 V. The resonant frequency ω is 250 rad/s. If the value of C is 4 μF , then the voltage across L is

a) 600 V b) 4000 V c) 400 V d) 1 V

9) The wave associated with a moving particle of mass 3×10^{-6} g has the same wavelength as an electron moving with a velocity 6×10^{6} ms^{-1}. The velocity of the particle is

a) 1.82×10^{-18} ms^{-1} b) 9×10^{-2} ms^{-1}

c) 3×10^{-31} ms^{-1} d) 1.82×10^{-15} ms^{-1}

10) Light transmitted by Nicol prism is

a) Partially polarised b) unpolarised

c) plane polarised d) elliptically polarised

11) 'Ski Wax' is an application of nano product in the field of

a) Medicine b) Textile

c) Sports d) Automative industry

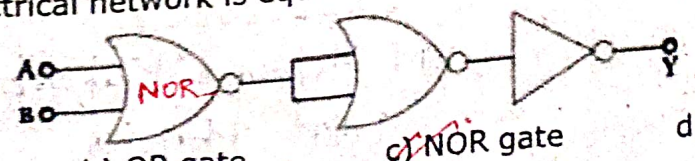
12) A tall man of height 6 feet wants to see his full image, then required minimum length of the mirror will be

a) 12 feet b) 3 feet c) 6 feet d) any length

13) Atomic number of H-like atom with ionization potential 122.4V for n=1 is

a) 1 b) 2 c) 3 d) 4

14) The given electrical network is equivalent to



a) AND gate b) OR gate c) NOR gate d) NOT gate

15) If yellow light emitted by sodium lamp in Young's double slit experiment is replaced by monochromatic blue light of the same intensity
a) fringe width will decrease b) fringe width will increase
c) fringe width will remains unchanged d) fringe becomes loss intense

PART - II

Answer any six of the following. Q.No. 18 is compulsory: **6×2=12**

16) Define: Current sensitivity. How will you increase current sensitivity of a galvanometer
17) State Huygen's principle
18) A copper wire of cross sectional area 0.5 mm^2 carries a current of 0.2A. If the free electron density of copper is $8.4 \times 10^{28}\ m^{-3}$, then computer the drift velocity of free electrons $0.03 \times 10^{-3}\ m$
19) What are the difference between coulomb force and gravitational force
20) Define: Work function of a metal. Give its unit.
21) What is meant by wattless current.
22) State De-morgan's theorms
23) Calculate the radius of $^{197}_{79}Au$ nucleus
24) Give two uses of IR radiation.

PART - III

Answer any six of the following. Q.No. 30 is compulsory: **6×3=18**

25) Derive the expression for electrostatic potential due to a point charge
26) Mention the various energy losses in a transformer.
27) Derive the relation between f and R for a spherical mirrors
28) Mention any two advantages and disadvantages of Robotics
29) Write any six properties of electromagnetic waves
30) Calculate the energy released when 1 kg of $^{235}_{92}U$ undergoes fission $8.192 \times 10^{13}\ J$
31) Derive the expression for de-Broglie wavelength of electrons
32) Discuss the conversion of galvanometer into voltmeter.
33) What is seeback effect. State the applications of seeback effect

PART - IV

Answer all the following. Draw the diagrams wherever necessary. **5×5=25**

34) Calculate the electric field due to a dipole on its axial line.

(OR)

Find out the phase relation between voltage and current is a pure inductive circuit

35) Describe Fizeau's method of determine the speed of light.

(OR)

Obtain the condition for bridge balance in wheat stone's bridge

36) What is emission spectrum Explain its types

(OR)

Discuss the diffraction at single slit and obtain the condition for n^{th} minimum.

37) Compare Dia, Para, Ferromagnetism

(OR)

Derive the expression for the radius and velocity of the electron in the n^{th} orbit of an atom using Bohr atom model.

38) Explain the construction and working of a full wave rectifier

(OR)

Obtain Einstein's photoelectric equation with necessary explanation.

- - - - - - -

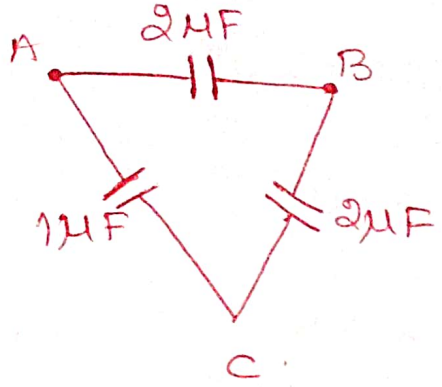
M. Jefrin Mufitha.
PGT - Physics.
Keins. Mat. Hr. Sec. School,
Vellagoil, Tirunelveli Dist.

Standard 12

PHYSICS

Answer key.

1)



Series connection: 2μF and 2μF.

$$C_S = \frac{1}{C_1} + \frac{1}{C_2} = \frac{1}{2} + \frac{1}{2} = 1\mu F$$

C_S is Parallel connection with 1μF.

$$C_P = C_S + 1\mu F$$

$$C_P = 1\mu F + 1\mu F = 2\mu F$$

3) $V = 240V$, $R = 120\Omega$, $P = ?$

$$P = I^2R = \frac{V^2}{R} = \frac{240 \times 240}{120}$$

$$= 240 \times 2 = 480\,W$$

$$\boxed{P = 480W}$$

4) $r = \sqrt{\frac{2qV}{m}}$, But $F = Bqv$

$$F = Bq\sqrt{\frac{2qV}{m}} = \sqrt{\frac{B^2q^2 \cdot 2qV}{m}}$$

$$\boxed{F = \sqrt{\frac{2B^2q^3V}{m}}} \quad (c).$$

5) Magnetic moment $\vec{M}' = \frac{\vec{M}}{2} = 0.5\,\vec{M}$ (d)

7) $r = 90°$. $i = i_c$

$$n > \frac{1}{\sin i} \; ; \; n > \frac{1}{\sin 45°}$$

$$n > \frac{1}{1/\sqrt{2}}$$

$$n > \sqrt{2} \Rightarrow n > 1.414$$

Ans: (d) $(n \geq 1.5)$.

8) In RLC, $R = 100\Omega$, $V = 40V$, $\omega = 250 rad/s$.

$C = 4\mu F = 4 \times 10^{-6} F$ then, $V_L = ?$

$$X_c = \frac{1}{C\omega} = \frac{1}{250 \times 4 \times 10^{-6}} = \frac{1}{1000 \times 10^{-6}}$$

$$= \frac{1}{10^3 \times 10^{-6}} = \frac{1}{10^{-3}} = 10^3 = 1000\,\Omega$$

$\therefore X_L = X_C$. and $I = \frac{V}{R} = \frac{40}{100} = 0.4 A$.

WKT, $V_L = I X_L = 0.4 \times 1000 = 400V$.

Ans; (c) : 400 V.

9) $m_p v_p = m_e v_e$

$$v_p = \frac{m_e v_e}{m_p} = \frac{9.1 \times 10^{-31} \times 2 \times 10^6}{3 \times 10^{-6}}$$

$$= 18.2 \times 10^{-25} \times 10^6$$

$$= 18.2 \times 10^{-19}$$

$$= 1.82 \times 10^{-18} \; ms^{-1}$$

12) $h = 6ft$,

minimum size of the plane mirror to see full object $= \frac{\text{Size of obj}}{2} = \frac{6ft}{2} = 3$

Ans: (b) 3 feet.

13) For H-atom,

$V_{ion} = 122.4\ V$, $n = 1$,

$$V_{ion} = \frac{13.6 z^2}{n^2}$$

$$122.4 = \frac{13.6 z^2}{n^2}$$

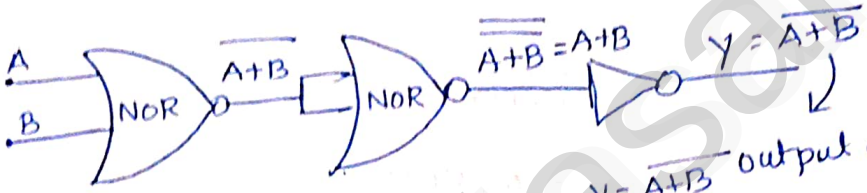
$$z^2 = \frac{122.4}{13.6} \times 1^2$$

$$z^2 = 9$$

$$\therefore \boxed{z = 3}$$

Ans : (C) = 3

14)



$[\because \bar{\bar{A}} = A]$

$Y = \overline{A+B}$ output of NOR gate.

Ans : (C) NOR Gate.

15) Fringe (Band) width $\beta = \frac{D\lambda}{d}$.

It's clear that $\beta \propto \lambda$.

And, If blue light is used instead of Yellow light, $\lambda_Y > \lambda_B$

If the wave length decreases due to blue light, fringe width will decrease.

Ans : (a) Fringe width will decrease.

Part - II

18) Given:

$A = 0.5\ mm^2$

$= 0.5 \times 10^{-3}\ m^2$.

Current, $I = 0.2A$. and $n = 8.4 \times 10^{28}\ m^{-3}$

$v_d = ?$

Solution:

$$v_d = \frac{I}{neA}$$

$$= \frac{0.2}{8.4 \times 10^{28} \times 1.6 \times 10^{-19} \times 0.5 \times 10^{-6}}$$

$$= \frac{0.2}{6.72 \times 10^{3}}$$

$$= 0.0297 \times 10^{-3}$$

$$v_d \simeq 0.03 \times 10^{-3}\ ms^{-1}$$

23) Given. $^{197}_{79}Au$

$$R = R_0 A^{1/3}$$

$$= 1.2 \times 10^{-15} \times (197)^{1/3}$$

$$= 6.97 \times 10^{-15}\ m$$

$$R = 6.97\ F$$

Part - III

39) Solution.

235 g of $^{235}_{92}U$ has 6.023×10^{23} atoms.

In 1g of $^{235}_{92}U$, the No. of atoms equal to

$$= \frac{6.023 \times 10^{23}}{235}$$

$$= 2.56 \times 10^{21}.$$

∴ No. of atoms in 1kg of $^{235}_{92}U = 2.56 \times 10^{21} \times 1000$

$= 2.56 \times 10^{24}$

Each $^{235}_{92}U$ releases 200MeV of energy during fission.

∴ Total energy released by 1kg of $^{235}_{92}U$ is,

$$Q = 2.56 \times 10^{24} \times 200 \text{ MeV}$$

$$= 5.12 \times 10^{26} \text{ MeV}$$

In Joules,

$$Q = 5.12 \times 10^{26} \times 1.6 \times 10^{-13} \text{ J}$$

$$= 8.192 \times 10^{13} \text{ J}.$$

In kilowatt hour,

$$Q = \frac{8.192 \times 10^{13}}{3.6 \times 10^{6}} = 2.27 \times 10^{7} \text{ kWh}$$