CUET Physics Solved Paper-2023

Held on 22 May 2023 (Shift-II)

1. In a potentiometer arrangement, a cell of emf 1.5 V gives a balance point at 45.0 cm length of the wire. If the cell is replaced by another cell of emf 2.25 V. Where will the balance point shift to?
   (a) 63.0 cm (b) 67.5 cm
   (c) 100.0 cm (d) 90.0 cm

2. In a feedback amplifier, if the feedback voltage is in opposite phase, the gain is less than 1. Then it will:
   (a) Never work as an Oscillator
   (b) Work as an Oscillator
   (c) Not work as an Oscillator
   (d) Work as a rectifier

3. In a concave mirror, an object is placed at a distance x from the focus and the image is formed at a distance y from the focus. What is the focal length of the mirror?
   (a) $(xy)^{\frac{1}{2}}$ (b) $\frac{(x+y)}{2}$
   (c) xy^{-1} (d) xy

4. Arrange the following in the increasing order of de-Broglie wavelength:
   A. A bullet of mass 0.02kg travelling at the speed of 3.3 Km/s.
   B. A ball of mass 0.0331kg moving with speed of 2 m/s.
   C. A dust particle of mass 2×10^{-10} Kg drifting with a speed of 3.3 m/s.
   D. A photon having a momentum of 6.63×10^{-26} kg m/s.
   E. An electron accelerated through a potential difference of 100 V.

   Choose the correct answer from the options given below:
   (a) B<A<C<E<D
   (b) B<A<C<D<E
   (c) B<A<C<D<E
   (d) A<B<C<E<D

5. The current voltage in ac circuit are given by I = 5 $\sin\left(100t-\frac{\pi}{2}\right)$ A and V = 200 sin (100t) V. The power dissipated in the circuit is
   (a) 20W (b) 40W
   (c) 0 (d) 1000V

6. Match the different types of Electro Magnetic Waves and their detections

LIST I Electro Magnetic waves		LIST II Detection of Electromagnet wave
A. Light	I.	Receiver's arial
B. Infra red	II.	Point contact diodes
C. Radiowave	III.	Photocells
D. Microwave	IV.	Thermopiles.

   Choose the correct answer from the options given below:
   (a) A-IV, B-III, C-II, D-I
   (b) A-III, B-IV, C-I, D-II
   (c) A-II, B-I, C-III, D-IV
   (d) A-I, B-II, C-IV, D-III

7. Match List I with List II

LIST I (Quantity)		LIST II (Variation with distance 'r')
A. Electric field intensity (E) due to a single charge	I.	$\alpha\frac{1}{r}$
B. Electric field intensity due to electric dipole	II.	$\alpha\frac{1}{r^4}$
C. Electric potential (V)due to a single charge	III	$\alpha\frac{1}{r^3}$
D. Electric field intensity due to a quadrupole	IV.	$\alpha\frac{1}{r^2}$

   Choose the correct answer from the options given below:
   (a) A-IV, B-III, C-II, D-I
   (b) A-I, B-II, C-III, D-IV
   (c) A-III, B-IV, C-II, D-I
   (d) A-IV, B-III, C-I, D-II

8. Match List I with List II

List I		List II
A. Gyromagnetic ratio	I.	4×10^{-5} T
B. Permeability of free space	II.	9.27×10^{-24} Am^2
C. Earth's magnetic field at equator	III.	8.8×10^{-10} C/kg
D. Bohr magnetron	IV.	12.56×10^{-7} T m A^{-1}

   Choose the correct answer from the options given below:
   (a) A-III, B-IV, C-II, D-I
   (b) A-IV, B-III, C-II, D-I
   (c) A-III, B-IV, C-I, D-II
   (d) A-II, B-III, C-IV, D-I

9. A parallel plate air capacitor has a capacity 'C', distance of separation between its plates is 'x' and potential difference applied across the plates is V. What is the force of attraction between the plates of the parallel plate air capacitor?

(a) $\frac{C^2V^2}{2x^2}$ (b) $\frac{CV^2}{x}$

(c) $\frac{C^2V^2}{2x}$ (d) $\frac{CV^2}{2x}$

10. Which of the following statements are correct?

A. Two major types of resistors are wire bound resistors and carbon resistors.
B. Mobility is the drift velocity per unit electric field.
C. The internal resistance of dry cells is much lower than the common electrolytic cells.
D. In electrolytic liquids, electrons carry the electric current.
E. Potentiometer is unaffected by the internal resistance of the source.

Choose the correct answer from the options given below:
(a) A, B and E only (b) B, C, D and E only
(c) C, D, and E only (d) D and E only

11. An infinitely long straight conductor carries a current of 150 A. At what distance from the conductor is the magnetic field caused by the current equal to 10^{-4} T?
(a) 1.5 m (b) 0.3 m
(c) 3.0 m (d) 0.15 m

12. As per Bohr's model the energy (in eV) required to remove electron from ground state of Li++ (doubly ionised lithium atom) is
(a) 1.51 (b) 13.6
(c) 40.8 (d) 122.4

13. For transmitting a modulated signal of wave length λ, the antenna should have minimum size:

(a) λ (b) $\frac{\lambda}{2}$

(c) $\frac{\lambda}{4}$ (d) 2λ

14. A telescope has an objective lens of 0.1 m diameter and is situated at a distance of 500 m from two objects. What will be the minimum distance between these two objects which can be resolved by the telescope. The mean wavelength of light is 600 nm.
(a) 1.46 mm (b) 0.37 mm
(c) 3.66 mm (d) 1.21 mm

15. Which one of the following can not be polarized?
(a) Light waves (b) Sound waves
(c) X- rays (d) Radio-waves

16. Which of the following statements are correct?
A. Moving charges produce a magnetic field in the surrounding space.
B. An instrument called the current balance is used to measure mechanical force between two parallel conductors.
C. The electron has an intrinsic magnetic moment, which is known as the orbital magnetic moment.
D. Magnetic field of several sources is the vector addition of magnetic field of each individual source.
E. The radius of the circular component of motion is called the radius of the helix.

Choose the correct answer from the options given below:
(a) A and C only
(b) B, C and E only
(c) A, C, D and E only
(d) A, B, D and E only

17. When a steady current flows in a metalic conductor of non- uniform cross section. Which of these quantities is constant along the conductor?
A. Current B. Electric field
C. Drift speed D. Current density
E. Potential gradient
Potential gradient Choose the correct answer from the options given below:
(a) D only (b) A, B and D only
(c) C and E only (d) A only

18. At the time of sun set the sun appears to be at an altitude higher than its actual position. This is because of
(a) Absorption of light
(b) Reflection of light
(c) Refraction of light
(d) Dispersion of light

19. A Television transmitting antenna is 84m tall. How much service area can it cover, if the receiving antenna is at the ground level?

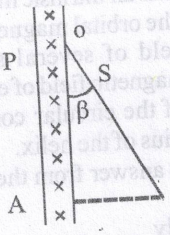
(Given $\pi = \frac{22}{7}$)
(a) 721 km^2 (b) 1075 km^2
(c) 1690 km^2 (d) 3379 km^2

20. When temperature of a ferromagnetic material is increased by 20%, What is the percentage change in it's magnetic susceptibility?
(a) 16.7% (b) 83.3%
(c) 1.67% (d) 8.33%

21. The refractive index of air with respect to glass $\frac{2}{3}$. The refractive index of diamond with respect to air is 2.4. What will be the refractive index of glass with respect to diamond?
(a) 0.28 (b) 0.625
(c) 1.60 (d) 3.60

22. A pure silicon crystal has 5×10^{28} atoms m^{-3}. It is doped by 2ppm concentration of pentavalent arsenic. The number of holes are:
Consider $n_i = 1.5 \times 10^{16} m^{-3}$
(a) $4.5 \times 10^9 m^{-3}$ (b) $2.25 \times 10^9 m^{-3}$
(c) $2.25 \times 10^{-9} m^{-3}$ (d) $4.5 \times 10^{-9} m^{-3}$

23. A charged ball 'M' hangs from a silk thread 'S' which makes and angle β, with a large charged conducting sheet 'P' as shown. The surface charge density σ of the sheet is proportional to



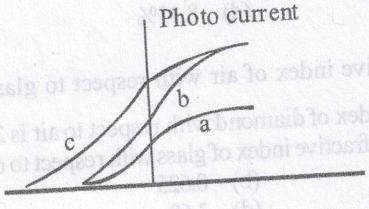
(a) tan B (b) sin B
(c) cot B (d) cos B

24. It potential difference V applied across a metallic wire is increased by V, how will the drift velocity of the electrons change?
(a) becomes half
(b) becomes twice
(c) becomes four times
(d) remains the same

25. A resistance of 15Ω is connected in series with an unknown resistance R_1. This combination is connected to one gap of a meter bridge, while a resistance R_2 is connected in the other gap. The balance point is at 50 cm. When 15 Ω is removed,the balance point shifts by 10 cm. The value of R_1 is
(a) 20Ω (b) 30Ω
(c) 40Ω (d) 60Ω

26. Which of the following gates can give an AND gate by its repetitive use?
(a) Both NAND gate and NOR gate
(b) NOT gate only
(c) OR gate only
(d) NAND gate only

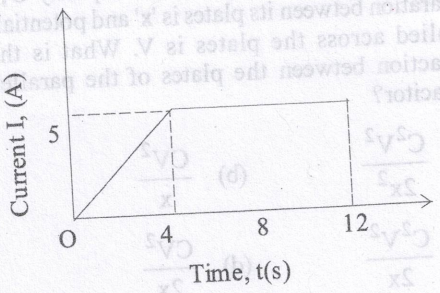
27. The figure shows the variation of photo current with anode potential for a photo-sensitive surface for three different radiations. Let I_a, I_b and I_c be the intensities surface and y_a, y_b, and y_c be the frequencies for the curves a, b and c respectively. Choose the correct statement.



(a) $y_a = y_b; I_b = I_c$ (b) $y_b = y_c; I_c = I_b$
(c) $y_a = y_c; I_c = I_b$ (d) $y_a = y_b; I_a = I_b$

28. In Young's double slits experiment, the light has a frequency 12×10^{14} Hz and the distance between the centers of adjacent fringes is 0.8 mm. If the screen is 1.6 m away, what is the distance between the slits?(Take speed of light $3 \times 10^8 \text{ m s}^{-1}$)
(a) 5.00×10^{-4} m (b) 5.92×10^{-4} m
(c) 2.00×10^{-4} m (d) 1.25×10^{-4} m

29. Figure below shows a plot of current I through the cross-section of a wire over a time interval of 12s. How much charge flows through the wire during this time period?



(a) 10C (b) 50C
(c) 20C (d) 25C

30. A radioactive isotope has a half life of T years. How long (in years) will it take the activity to reduce to 3.125% of it's original value?
(a) 4T (b) 5T
(c) 3T (d) 6T

31. The electron in a hydrogen atom rises from its n = 1 state to n =4 state by absorbing energy. The energy of the electron in the n = 1 state is – 13.6 eV. How much energy is absorbed by the electron in transition?
(a) –0.85 eV (b) 12.75 eV
(c) –12.75 eV (d) 0.85 eV

32. X-rays of wavelength $\lambda = 1\text{A}^\circ$ have frequency
(a) 3×10^8 Hz (b) 3×10^{18} Hz
(c) 3×10^{10} Hz (d) 3×10^{15} Hz

33. Which of the following statements are correct?
A. Dispersion is the splitting of light into it's constituent colours.
B. The unit for power of a lens is m^{-1}.
C. Optical fibres consist of glass fibres coated with a thin layer of material of higher refractive index.
D. Cassegrain telescope has the advantages of a large focal length in a short telescope.
E. Glass is a dispersive medium.
Choose the correct answer from the options given below:
(a) A, B, C and E Only
(b) A, B, D and E Only
(c) B, C, D and E Only
(d) C, D and E Only

34. Match List I with List II

List I	List II
A. Magnifying power of a simple microscope	I. $\frac{L}{f_o} \times \frac{D}{f_e}$
B. Magnifying power of a compound microscope	II. $\frac{f_o}{fe}\left(1+\frac{f_e}{D}\right)$
C. Magnifying Power of a telescope (normal adjustments)	III. $\left(1+\frac{D}{f_e}\right)$
D. Magnifying power of	IV. $f_o f_e^{-1}$

a telescope when final image is formed at least distance of distinct vision

(Symbols have their usual meanings)

Choose the correct answer from the options given below:

(a) A-II, B-IV, C-I, D-III
(b) A-IV, B-III, C-II, D-I
(c) A-III, B-I, C-IV, D-II
(d) A-I, B-II, C-III, D-IV

35. A metal plate i getting heated. It can be because of-

A. An alternating current is passing through the plate.
B. It is placed in a time varying magnitude field.
C. A direct current is passing through the plate.
D. It is placed in a space varying magnitude field, but does not vary with time.
E. It is placed in a time constant magnetic field.

Choose the correct answer from the options given below:

(a) A, B, C Only (b) C, D, E Only
(c) A, D, E Only (d) B, C, D Only

36. The total charge of an electric dipole is
(Where 'q' is the point charge on either side of the dipole and 'e' is the charge of an electron)

(a) 2e (b) $-2q$
(c) 2q (d) zero

37. The magnetic flux passing perpendicular to the plane of coil is changing according to the equation $\Phi = 6t^2 + 7t + 1$, where 'Φ' is in m Wb and 't' in sec.
The magnitude of induced emf at t = 2 s is

(a) 31mV (b) 38mV
(c) 39mV (d) 32mV

38. There is a solenoid of length 1 m has a radius of 1 cm and is made up of 1000 turns. It carries a current of 10 A. The magnitude of magnetic field inside the solenoid is

(a) $8\pi \times 10^{-3}$ T (b) $40\pi \times 10^{-3}$ T
(c) $4\pi \times 10^{-3}$ T (d) $0.4\pi \times 10^{-3}$ T

39. What is the approximate wavelength of the radiation emitted when the electron in an hydrogen atom jumps from $n = \infty$ to n = 3?

(a) 822 A° (b) 822 nm
(c) 8220 nm (d) 365 nm

40. When a number of capacitors are connected in parallel between two points increases, the equivalent capacitance

(a) Decreases
(b) Increases
(c) Remains the same
(d) Zero

41. The capacitance of a capacitor is 4 μ F and it's potential is 100 V. The energy released on discharging it fully will be

(a) 0.02 J (b) 0.04 J
(c) 0.025 J (d) 0.05 J

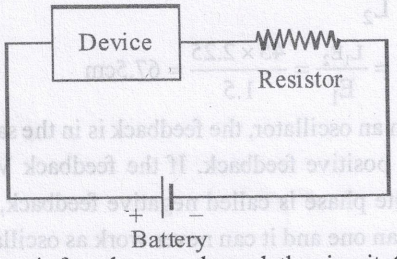
42. Which one among the following shows particle nature of light?

(a) Refraction
(b) Interference
(c) Photoelectric effect
(d) Polarisation

43. A metal conductor of length 1m rotates in vertial plane about an axis passing through one of its ends at angular velocity 4 rad s^{-1}. What is the emf developed between the two ends of the conductor, if the horizontal component of the earth's magnetic field is 0.2 G?

(a) 4mV (b) 40mV
(c) 4μV (d) 40μV

44. A semiconducting device is connected as shown in the figure



A current is found to pass through the circuit. On reversing the polarity of the battery. The current in the circuit drops to almost zero. What is this device?

(a) a P-type semiconductor
(b) an N-type semiconductor
(c) an intrinsic semiconductor
(d) a p-n junction diode

45. A charge Q is divided into two parts, q and (Q-q). The repulsion between them is maximum when Q : q is

(a) 2:1 (b) 1:2
(c) 4:1 (d) 1:4

46. For which of the following , a capacitor acts as an infinite resistance component in the circuit?

(a) Alternating current
(b) Direct current
(c) Alternating current as well as direct current
(d) Neither alternating current nor direct current

47. A proton and an alpha particle enter a uniform magnetic field with the same velocity and move along circular paths. The time period of the alpha particle will be:

(a) Four times that of proton
(b) Three times that of proton
(c) Same as that of proton
(d) Two times that of proton

48. Which of the following is not the property of β^- ray?

(a) The ionising power is less than that of α-particles.
(b) The penetrating power is greater than that of α-particles.
(c) It is made of positively charged particles.
(d) It is deflected by an electric as well as by a magnetic field.

49. Two coherent monochromatic light beams of intensities 16I and 4I are superposed. The maximum and minimum possible intensities in the resulting beam are-

(a) 20I and I (b) 36I and 4I
(c) 20I and 12I (d) 36I and I

50. Which of the following combinations should be used for better tuning of an LCR circuit used for communication?

(a) R = 25 Ω, 1 = 1.5H, C = 35 μ F
(b) R = 25 Ω, L = 2.0H, C = 45 μF
(c) R = 15 Ω, L = 3.5H, C = 30μF
(d) R = 15 Ω, L = 1.0H, C = 40μF

Hints & Explanations

1. **(b)** Given, $E_1 = 1.5\,V, L_1 = 45\,cm, E_2 = 2.25V$

Using the formula

$$\frac{E_1}{E_2} = \frac{L_1}{L_2}$$

$$\Rightarrow L_2 = \frac{L_1E_2}{E_1} = \frac{45 \times 2.25}{1.5} = 67.5cm$$

2. **(a)** In an oscillator, the feedback is in the same phase is called positive feedback. If the feedback Voltage is in opposite phase is called negative feedback, the gain is less than one and it can never work as oscillator.

3. **(a)** From the mirror formula

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

$$u = f - x, v = f - y$$

$$\frac{1}{f} = \frac{1}{f-x} + \frac{1}{f-y}$$

$$\frac{1}{f} = \frac{f-y+f-x}{(f-x)(f-y)}$$

$$(f-x)(f-y) = f[2f-x-y]$$

$$f^2 - fy - fx + xy = 2f^2 - fx - fy$$

$$\Rightarrow f = \sqrt{xy}$$

4. **(d)** A. $\lambda_A = \frac{h}{mv} = \frac{6.6 \times 10^{-34}}{0.02 \times 3.3 \times 10^3} = 10^{-35}\,m$

B. $\lambda_B = \frac{h}{mv} = \frac{6.6 \times 10^{-34}}{0.0331 \times 2} = 99.69 \times 10^{-34}\,m$

C. $\lambda = \frac{h}{mv} = \frac{6.6 \times 10^{-34}}{2 \times 10^{-10} \times 3.3} = 10^{-24}\,m$

D. $p = \frac{h}{\lambda} \Rightarrow \lambda = \frac{h}{p} = \frac{6.6 \times 10^{-34}}{6.63 \times 10^{-26}} = 1.1 \times 10^{-8}\,m$

E. $\lambda = \frac{h}{\sqrt{2mev}} = \sqrt{\frac{150}{v}} = \sqrt{\frac{150}{100}} = 1.2247 \times 10^{-10}\,m$

5 **(d)** $I = 5\sin\left(100t - \frac{\pi}{2}\right) A$

$V = 200 \sin(100\,t)\,V$

power, $p = IV$

$= 5 \times 200 = 1000W$

6. **(b)** Photocell detects light.

7. **(d)** Electric field due to a single charge

$$E \propto \frac{1}{r^2}$$

Electric potential (v) due to a single charge

$$V \propto \frac{1}{r}$$

Electric field intensity due to electric dipole

$$E \propto \frac{1}{r^3}$$

Electric field intensity due to a quadrupale

$$E \propto \frac{1}{r^4}$$

8. **(c)**

9. **(d)** The force of attraction between the plates of the parallel plate air capacitor $F = \frac{-du}{dx}$

Potential energy, $U = \frac{1}{2}CV^2$

$$\therefore C = \frac{\varepsilon_o A}{x}$$

$$= \frac{1}{2}\frac{\varepsilon_o A}{x}V^2$$

$$F = +\frac{1}{2}\frac{\varepsilon_o A}{x^2}V^2$$

$$F = \frac{CV^2}{2x}$$

10. **(a)** The internal resistance of dry cells is generally higher than the common electrolytic cells.

The preferred movement of ions under the influence of electric field is responsible for electric current.

11. **(b)** Current, $I = 150\,A$

Magnetic field, $B = 10^{-4}$

$$B = \frac{\mu_o I}{2\pi r}$$

$$\Rightarrow r = \frac{4\pi \times 10^{-7} \times 150}{2\pi \times 10^{-4}} = 0.3\,m$$

12. **(d)** According to Bohr model,

$$E = \frac{-13.6z^2}{n^2}eV$$

$n = 1$ for ground state

$$= \frac{-13.6 \times 3^2}{1^2} = 122.4eV$$

13. **(c)** The minimum size of the antenna required to send the electromagnetic wave signal is given as

$$L = \frac{\lambda}{4}$$

14. **(c)** Wavelength of light, $\lambda = 600\times10^{-9}$m

Resolving power, $\theta = \frac{1.22\lambda}{a} = \frac{d}{D}$

Diameter of objective lens, a = 0.1m

The minimum distance between these two objects

$$d = \frac{1.22D\lambda}{a}$$

$$= \frac{122\times600\times10^{-9}\times500}{0.1} = 3.66\,mm$$

15. **(b)** Polarisation can not happen with longitudinal waves as there is only one phase of vibration and that is along the direction of motion of the wave.

So, sound wave is longitudinal and polarization can not take place.

16. **(d)**

17. **(d)** When a steady current flows in a metallic conductor of non-uniform cross-section then the drift speed, $v_d = \frac{I}{neA}$.

Electric field, $E = \frac{I}{\rho A}$

$$\Rightarrow v_d \propto \frac{1}{A};\ E \propto \frac{I}{A}$$

Only current remain constant.

18. **(c)** The refraction of light through the atmosphere is responsible at the time of sunset the sun appears to be at an altitude higher than its actual position.

19. **(d)** Given, $H_T = 84$ m, $H_R = 0$

The distance of receiving signal given as

$$d_{max} = \sqrt{2RH_t} + \sqrt{2RH_H}$$

$$= \sqrt{\frac{2\times6400\times84}{1000}} = 32.79\,m$$

The area of service will be

$A = Hd^2_{max}$

$$= \frac{22}{7}\times(32.79)^2 = 3379km^2$$

20. **(c)** According to curies law's

$$X_m \propto \frac{1}{T}$$

$T_1 = T$

$T_2 = T + 20\,T = 1.20T$

$$\frac{Xm_2}{Xm_1} = \frac{T_1}{T_2} = \frac{T}{1.20T} = \frac{1}{1.2}$$

$Xm_2 = 0.833\,Xm_1$

$$\left|\frac{Xm_1 - Xm_2}{Xm_1}\right| = \left|\frac{Xm_1 - 0.833Xm_1}{Xm_1}\right| = 1.67\%$$

21. **(b)** Given, $\frac{\mu air}{\mu glass} = \frac{2}{3}$ ...(1)

$$\frac{\mu diamond}{\mu air} = 2.4 \quad ...(2)$$

Multiply (1) and (2), we have

$$\frac{\mu diamond}{\mu glass} = \frac{2}{3}\times2.4 = 1.6$$

$$\frac{\mu glass}{\mu diamond} = \frac{1}{1.6} = 0.625$$

22. **(b)** $n_i = 1.5\times10^{16}\,m^{-3}$

5×10^{28} atom is doped by 2 ppm

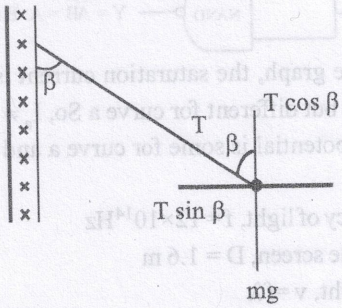
$$n_e = \frac{2\times5\times10^{28}}{10^6} = 10\times10^{22}\,m^{-3}$$

Number of hole, $n_n = \frac{no^2}{ne}$

$$= \frac{\left(1.5\times10^{16}\right)^2}{10\times10^2}$$

$$= 2.25\times10^9\,m^{-3}$$

23. **(a)**



$T\cos\beta = mg$ ...(1)

$T\sin\beta = q\,E = \frac{q\sigma}{\varepsilon_o}$ ...(2)

Divide equation (2) by (1), we have

$$\tan\beta = \frac{q\sigma}{\varepsilon_o mg} \Rightarrow \sigma \propto \tan\beta$$

24. **(b)** The drift velocity of the electron is given by

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

From the ohm's law

$V = IR$

$$V_d = \frac{V}{neAR}; V_d \propto V$$

Hence, the drift velocity of the electron will becomes twice.

25. (b) In first case balance condition

$$\frac{R_1+15}{R_2} = \frac{50}{100-50} = \frac{50}{50} = 1$$

$$R_1 + 15 = R_2 \quad \ldots(1)$$

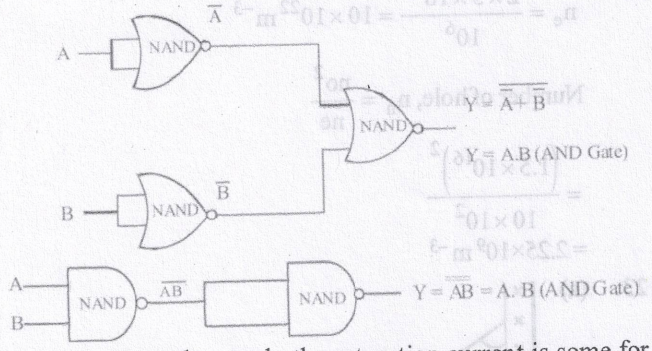
In second case balances condition

$$\frac{R_1}{R_2} = \frac{40}{100-40} = \frac{40}{60} = \frac{2}{3}$$

$$R_1 + 15 = \frac{3R_1}{2}$$

$$\frac{R_1}{2} = 15 \Rightarrow R_1 = 30\Omega$$

26. (a)



27. (a) From the graph, the saturation current is some for curve b and c but different for curve a So, $I_a \neq I_b = I_c$

As stopping potential is some for curve a and b.

Hence, $\gamma_a = \gamma_b$

28. (a) Frequency of light, $f = 12\times10^{14}$Hz

Distance of the screen, $D = 1.6$ m

Velocity of light, $v = f\lambda$

$$\Rightarrow \text{wave length, } \lambda = \frac{v}{f}$$

$$= \frac{3\times108}{12\times10^{14}} = \frac{1}{4}\times10^{-6}\text{m}$$

The difference between centers of adjacent fringes

$\beta = 0.8\times10^{-3}$

$$\beta = \frac{\lambda D}{d}$$

$$\Rightarrow d = \frac{\lambda D}{b} = \frac{10^{-6}\times1.6}{4\times0.8\times10^{-3}\text{m}} = 5\times10^{-4}\text{m}$$

29. (b) Charge = Area under the curve

$$= \frac{1}{2}\times4\times5 + 5\times(12-4)$$

$$= 10+40 = 50\,C$$

30. (b) Half life, $t_{1/2} = T$ years

$$N = N_o\left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$$

$$3.125 = \left(\frac{1}{2}\right)^{\frac{t}{T}}$$

$$\left(\frac{1}{2}\right)^{\frac{t}{T}} = \frac{3.125}{100} = \frac{1}{32}$$

$$\left(\frac{1}{2}\right)^{\frac{t}{T}} = \left(\frac{1}{2}\right)^5$$

$$\Rightarrow t = 5T$$

31. (b) The energy is absorbed by the electron

$$\Delta E = E_4 - E_1$$

$$= -\frac{13.6}{4^2} - -\frac{13.6}{(1)^2} = -\frac{13.6}{16} + 13.6$$

$$= 12.75\text{ eV}$$

32. (b) Wave length of x-ray, $\lambda = 10^{-10}$ m

$$\text{frequency, } f = \frac{C}{\lambda} = \frac{3\times10^8}{10^{-10}} = 3\times10^{-18}\text{ Hz}$$

33. (a) Discription is the sptitting of light into its constituents colors.

34. (c)

35. (a)

36. (d) Since an electric dipole is a pair of equal and opposite charges, therfore the total charge in an electric dipole will be zero.

37. (a) Given, $\phi = 6t^2 + 7t + 1$

$$\text{Induced emf, } \varepsilon = \left|\frac{-d\phi}{dt}\right|$$

$$= [12\,t + 4]$$

$$= [12\times2 + 7]$$

$$= 31\text{ mv}$$

38. (c) Length of Solienoid, $L = 1$ m

Radius, $r = 10^{-2}$ m

number of turns, $n = 1000$

current, $i = 10$ A

The magnitude of magnetic field

$$B = \frac{\mu_o n_i}{L}$$

$$= 4\pi\times10^{-7}\times1000\times10 = 4\pi\times10^{-3}\,T$$

39. **(b)** $\frac{1}{\lambda}=R\left[\frac{1}{n_j^2}-\frac{1}{n_f^2}\right]$

$\frac{1}{\lambda}=R\left[\frac{1}{3^2}-\frac{1}{\infty}\right]$

$\frac{1}{\lambda}=\frac{R}{9}$

$\Rightarrow \lambda=\frac{9}{R}=\frac{9}{1.1\times10^7}=822\,nm$

40. **(a)** $C=\frac{\varepsilon_o A}{d}$

When a number of capacitor are connected in parallel between two point increases, the equivalent capacitance decreases.

41. **(a)** Capacitor of capacitance, $C=4\times10^{-6}\,F$

Potential, $V=100V$

The energy released on discharging

$U=\frac{1}{2}CV^2=\frac{1}{2}\times4\times10^{-6}\times(100)^2$

$=0.02\,J$

42. **(c)** Photo electric effect shows Particle, nature of light

43. **(d)** The induced emf is given by

$\varepsilon=\frac{Blv}{2}=\frac{1}{2}Bl^2w$

$=\frac{1}{2}\times0.2\times10^{-4}\times(1)^2\times4$

$=40\mu v$

44. **(d)** This device will be p. n junction diode. In the previous polarity, the p-n junction will be forward biased and allow to pass current through it. After reversing the polarity, it will be in reverse. Which will hot allow current to pass through it.

45. **(a)** The repulsion forces is given by

$F=\frac{kq(Q-q)}{r^2}$

for maximum force, $\frac{dF}{dq}=0$

$O=\frac{k(Q-2q)}{r^2}$

$Q^{-2}\varepsilon=0$

$\Rightarrow\frac{Q}{\varepsilon}=\frac{2}{T}$

46. **(b)** In caso of Dc, the capacitor is fully charged thus the potential difference across it becomes equal to the voltage of the source. As a result the capacitor now acts as an open circuit and thus, there is no more flow of charge in this circuit. So, fully charged capacitor acts as an infinite resistance for Dc.

47. **(d)** for proton

Time period, $T_1=\frac{2\pi m_2}{qB}=\frac{2\pi m}{qB}$

Here, magnetic field is uniform

for alpha particle

$T_2=\frac{2\pi m_2}{\varepsilon B}=\frac{2\pi\times4m}{2qB}=2T_1\ (\because\ m\alpha=4m)$

48. **(c)** β- ray is made of negativily charged particle.

49. **(b)** $I_1=16I$

$I_2=4I$

$I_1=A_1^2=16I$

$I_2=A_2^2=4I$

$A_1=\sqrt{16I}=4\sqrt{I}$

$A_2=2\sqrt{I}$

Maximum intensitites, $I_{max}=(A_1+A_2)^2$

$=\left(\sqrt[4]{I}+\sqrt[2]{I}\right)^2=\left(\sqrt[6]{I}\right)^2=36I$

Minimum intensities, $I\,min=(A_1-A_2)2$

$=\left(\sqrt[4]{I}-\sqrt[2]{I}\right)^2=4I$

50. **(c)** For tuning a LCR circuit, its selectivity should be high. High selectivity is observed in circuits with high quality factor.

$Q=\frac{\sqrt{L}}{R\sqrt{C}}=\frac{\sqrt{3.5}}{15\sqrt{30\times10^{-6}}}=22.76$