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Previous Year Paper

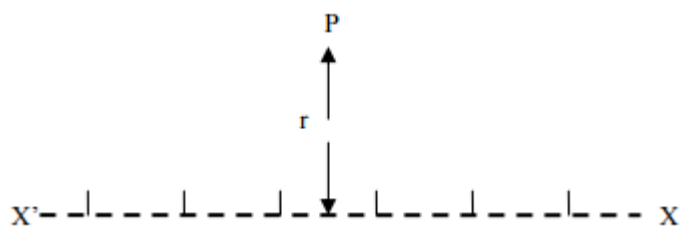
Physics - 2010

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Multiple Choice Questions

1. Electric field intensity 'E' at a point P (Figure 1) at a perpendicular distance 'r' from an infinitely long line charge X'X having linear charge density λ is given by:



- A. $E = \left(\frac{1}{4\pi\epsilon_0} \right) \frac{2\lambda}{r^2}$
 B. $E = \left(\frac{1}{4\pi\epsilon_0} \right) \frac{2\lambda}{r}$
 C. $E = \left(\frac{1}{4\pi\epsilon_0} \right) \frac{\lambda}{r^2}$
 D. $E = \left(\frac{1}{4\pi\epsilon_0} \right) \frac{\lambda}{r}$

Answer

2. A moving coil galvanometer can be converted into a voltmeter by connecting:
- A low resistance in series with its coil.
 - A low resistance in parallel with its coil.
 - A high resistance in parallel with its coil.
 - A high resistance in series with its coil.

Answer

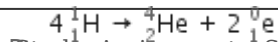
3. The loss of power in a transformer can be reduced by:
- Increasing the number of turns in primary
 - Increasing ac voltage applied to primary.
 - Using a solid core made of steel.
 - Using a solid core made of steel.

Answer

4. Which equation represents the emission of a beta particle by a radioactive nucleus:

- A. ${}_0^1n \rightarrow {}_1^1H + {}_{-1}^0e + \nu$
 B. $\gamma \rightarrow {}_1^0e + {}_{-1}^0e$

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Answer

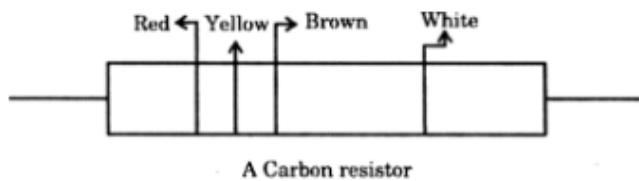
5. An important component of Michelson's method to determine speed of light is:
- A NICOL prism
 - A bi prism
 - A grating
 - A grating

Answer



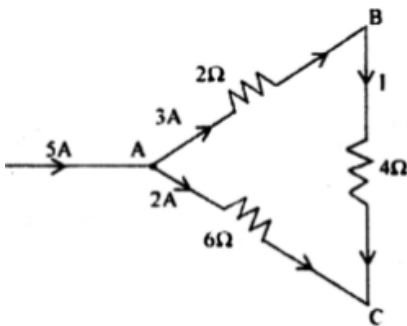
Short Answer Type

6. In an electric dipole, what is the locus of a point of zero potential? [Answer](#)
7. What is the resistance of a carbon resistor whose coloured bands are shown below in figure below:



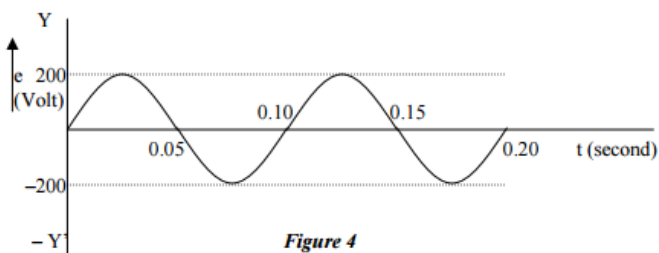
Answer

8. A part of an electric circuit is shown below figure below:



Using Kirchhoffs 2nd Law, find the current I flowing through the 4 Ω resistor. [Answer](#)

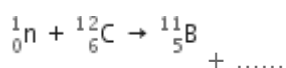
9. Figure below shows a graph of emf 'e' generated by an ac generator versus time 't':



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What is the frequency of the emf? [Answer](#)

10. Arrange the three types of magnetic materials, i.e., paramagnetic, diamagnetic and ferromagnetic materials, in decreasing order of their magnetic susceptibility. [Answer](#)
11. Which electromagnetic wave is longer than X-ray but shorter than light wave? [Answer](#)
12. Calculate the critical angle for glass and water pair. [Answer](#)
13. Name an optical device, which when used with a spectrometer, can determine the wavelength of the given monochromatic light. [Answer](#)
14. Young's double slit experiment was performed with monochromatic light of blue colour. The experiment was then repeated, first with light of red colour and then with light of yellow colour. Which colour produces interference pattern with maximum fringe separation (i.e., fringe width)? [Answer](#)
15. Calculate dispersive power of glass, accurately up to decimal places, from the following data:
 Refractive index of glass for red colour = 1.60
 Refractive index of glass for yellow colour = 1.61
 Refractive index of glass for violet colour = 1.62
[Answer](#)
16. De Broglie wavelength of electrons of kinetic energy E is λ . What will be its value if kinetic energy of electrons is made $4E$? [Answer](#)
17. How much energy will be created if 1 g of matter is destroyed completely? [Answer](#)
18. Complete the following nuclear reaction:



[Answer](#)

19. State one important use of a Zener diode. [Answer](#)
20. Draw a labelled graph of voltage versus time for a signal voltage used in digital circuits. [Answer](#)
21. An isolated $16 \mu\text{F}$ parallel plate air capacitor has a potential differences of 1000 V (Figure 5 a). A dielectric slab having relative permittivity (i.e. dielectric constant) = 5 is introduced to fill the space between the two plates completely. (Figure 5 b). Calculate:
 - (i) The new capacitance of the capacitor.
 - (ii) The new potential differences between the two plates of the capacitor

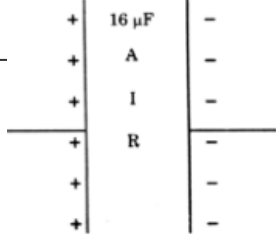


Fig 5(a)

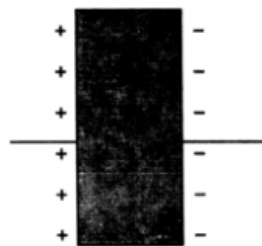


Fig 5(b)

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[Answer](#)

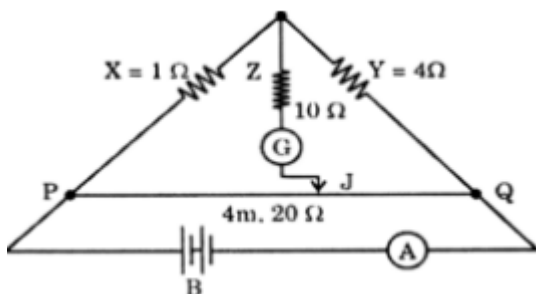
22. An electron revolves around the nucleus of hydrogen atom in a circular orbit of radius 5×10^{-11} m. Calculate
- Intensity of electric field of the nucleus at the position of the electron.
 - Electrostatic potential energy of the hydrogen nucleus and electron system.

[Answer](#)

23. (i) What is Peltier effect? State one difference between Peltier effect and Seebeck effect,
- (ii) Explain the statement: temperature coefficient of resistance of a metal is $4 \times 10^{-3} / ^\circ \text{C}$.

[Answer](#)

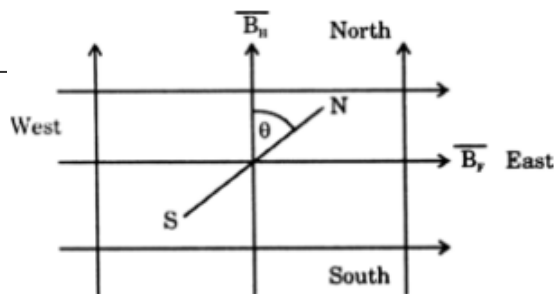
24. In the circuit shown below, PQ is a uniform metallic wire of length 4 m and resistance 20Ω . Battery B has an emf of 10V and internal resistance of 1Ω . J is a jockey or slide contact. Resistance of the ammeter and connecting wires is negligible.



- When the jockey J does not touch the wire PQ, what is the reading of ammeter A?
- Where should the jockey J be pressed on the wire PQ so that the galvanometer G shows no deflection?

[Answer](#)

25. What is 'current density'? Write the vector equation connecting current density $\vec{J}$ with electric field intensity $\vec{E}$, for an ohmic conductor. [Answer](#)
26. A small magnetic needle NS having magnetic dipole moment $\vec{P}_m$ is kept in two uniform and perpendicular magnetic fields $\vec{B}_F$ and $\vec{B}_H$ as shown below:

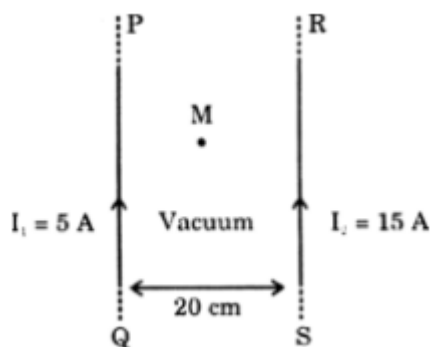


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- (i) What is the effect of each of the magnetic fields $\vec{B}_F$ and $\vec{B}_H$ on the needle?
- (ii) When the needle is in equilibrium, obtain an expression for an angle θ made by the needle with $\vec{B}_F$ in terms of $\vec{B}_F$ and $\vec{B}_H$ of only.

Answer

27. Figure 8 below shows two very long conductors PQ and RS kept parallel to each other in vacuum at a distance of 20 cm they carry currents of 5A and 15A, respectively, in the same direction, as shown. Find the resultant magnetic flux density $\vec{B}_R$ at a point M which lies exactly midway between PQ and RS.



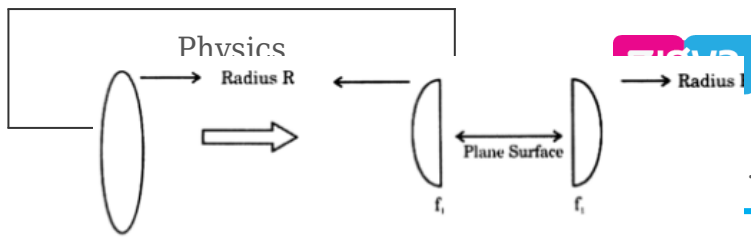
Answer

28. With the help of a neatly drawn labeled diagram, prove that the magnitude of motional emf 'e' is given by $e = Blv$, where 'l' is the length of a metallic rod and 'v' is the velocity with which it is pulled in a transverse magnetic field 'B'. Answer
29. Plot a labeled graph showing variation in impedance Z of a series LCR circuit with frequency f of alternating emf applied to it. What is the minimum value of this impedance? Answer
30. On the basis of Huygen's wave theory, show that light is incident on a plane mirror obliquely; angle of reflection is equal to angle of incidence. Answer
31. (i) What is a continuous emission spectrum? Name one source of light which produces such a spectrum.
- (ii) Explain in brief why dark lines are observed in the solar spectrum.

Answer

32. An equiconvex lens of glass, having focal length of 10 cm is split into two identical Plano convex lenses each having focal length f_j as shown below.

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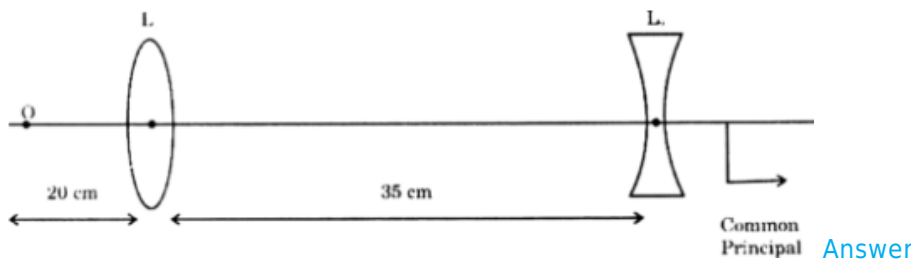


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Answer

33. An illuminated point object O is kept 20 cm from a thin convex lens L_1 of focal length 15 cm as shown below. A thin diverging lens L_2 of focal length 25 cm is kept co-axial with the first lens and 35 cm from it, as shown in Figure 10. Find the position of the final image formed by this combination of lenses.



34. (i) What are coherent sources?
(ii) In young's double slit experiment, what is the path differences between the two light waves forming 5th bright band (fringe) on the screen?

Answer

35. State one similarity and one difference between interference of light and diffraction of light.

Answer

36. A ray EF of monochromatic light is incident on the refracting surface AB of a regular glass prism (refractive index = 1.5) at an angle of incidence of $i = 55^\circ$ (Figure 11). If it emerges through the adjacent face AC, calculate the right angle of emergence 'e'.

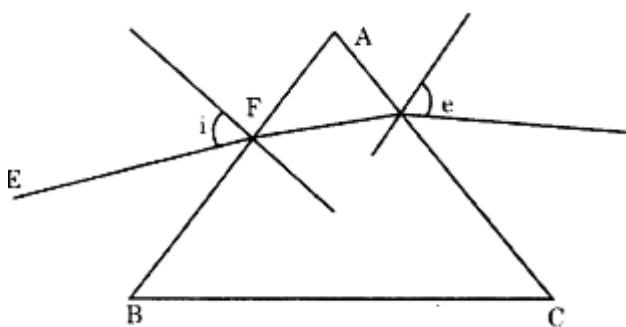


Figure 11

Answer

37. (i) In case of polarized light, what is means by the plane of polarization?
(ii) Find refractive index of glass if its polarising angle is 60° .

Answer

38. (i) Explain the statement: "Angular magnification of a compound microscope in normal use is 30".
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Answer

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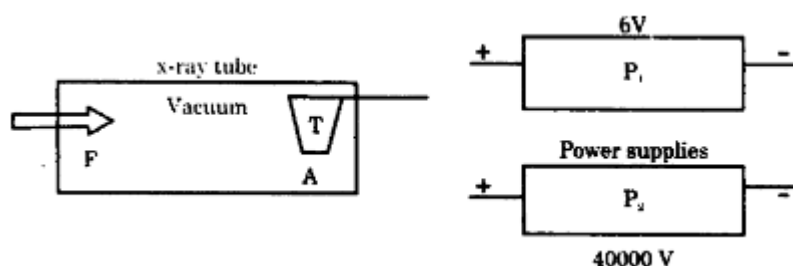
39. In Millikan's oil drop experiment, the two plates are 2 cm apart. When a potential difference of 2355 V is applied between them, an oil drop of radius $1\mu\text{m}$ is found to remain suspended.

Calculate the number of excess electrons on the drop,

[Density of oil = 900 kg/m^3 = Density of air may be ignored]

Answer

40. Figure 12 below shows a simple X ray tube. P_1 and P_2 are power supplies which generate 6 V and 40,000 V respectively. Show how you will connect these power supplies to the X ray tube so that it starts producing X rays.



Answer

41. (i) Write a balanced equation showing nuclear fission of Uranium $^{235}_{92}\text{U}$ nucleus.
 (ii) In a nuclear reactor, what is the function of:
 (1) Cadmium rods? (2) Graphite rods?

Answer

42. Starting with $N = N_0 e^{-\lambda t}$, obtain a relation between disintegration constant ' λ ' of a radioactive element and its half life (T), various terms have their usual meaning. [Answer](#)
43. On an energy level diagram of hydrogen, show by a downward or an upward arrow, a transition which results in:
 (i) Emission line of Balmer series.
 (ii) Emission line of Lyman series.
 (iii) Absorption line of Lyman series.

Answer

44. Calculate:

i) Mass defect of helium ^4_2He nucleus and

ii)

Its binding energy in MeV.

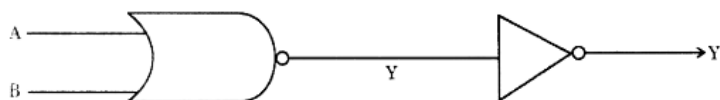
Mass of a proton = 1.007276 u

Mass of a neutron = 1.008665 u

[Answer](#)

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45. Draw a labelled diagram of a common emitter amplifier. What is the phase angle between the input and output voltages? [Answer](#)
46. Threshold wavelength of a certain metal is 792 nm. What is the maximum kinetic energy of photo-electrons emitted by this metal if it is exposed to ultraviolet light of wavelength 396 nm?
- [Answer](#)
47. The following combination of gates acts as a logic gate. With the help of a truth table, find out which logic gate the combination represents:



[Answer](#)