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Previous Year Paper

Physics - 2005

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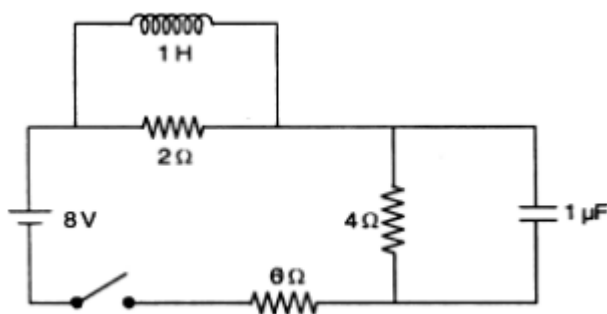


Short Answer Type

1. A 900 pF capacitor is charged by a 100V battery. How much energy is stored by the capacitor ?
[Answer](#)
2. An AC voltage of 200 V is applied to the primary of a transformer and a voltage of 2000 V is obtained from the secondary. Calculate the ratio of current passing through the primary to that in the secondary coil. [Answer](#)
3. If the temperature of the cold junction of a thermocouple is lowered, what will be the effect on its neutral temperature and temperature of inversion ? [Answer](#)
4. A charge of 5C is placed at the centre of a circle of radius 10 cm as shown in the figure below. Calculate the work done in moving a charge of 2C from point A to B on the circumference of the circle. [Answer](#)
5. A 2V battery with internal resistance of 0.1Ω is charged with a current of 5A. Calculate the potential difference between the terminals of the battery. [Answer](#)
6. A rectangular coil of area 50 cm^2 and 100 turns is placed perpendicular to a magnetic field of 10^{-2} Wb/m^2 . If the coil is withdrawn from the field in 40 milliseconds, calculate the emf induced.
[Answer](#)
7. The electric main in a house is marked 220 V - 50 Hz. Write down the equation for the instantaneous voltage. The only variable in this equation should be 't' [Answer](#)
8. An ideal inductor in an ac circuit consumes no power, though both 'V' and 'I' are non zero. Why ?
[Answer](#)
9. State Ampere's circuital law. [Answer](#)
10. Light of wavelength $4500 \text{ \AA}$ in vacuum enters into a glass block of refractive index 1.5. What is the wavelength of light in the glass block ? [Answer](#)
11. Show that S.I. unit of illuminance lux is equal to lumen/meter² . [Answer](#)
12. Light is incident on a block of glass at the polarizing angle. How does this polarising angle vary with the wavelength of light ? [Answer](#)
13. Fraunhofer diffraction from a single slit of width $1.24 \times 10^{-6} \text{ m}$ is observed with light of wavelength $6200 \text{ \AA}$. Calculate the angular width of the central maximum [Answer](#)
14. Refractive index of the material of a concave lens is μ . The lens is immersed in a medium of refractive index μ_1 ($\mu_1 > \mu$) . A parallel beam of light is incident on the lens. Draw a diagram to show the path of emergent rays. [Answer](#)
15. For an achromatic combination of lenses in contact, why should the lenses be of opposite nature
[Answer](#)

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16. An electron and a proton possess the same kinetic energy. Which of the two has shorter de-Broglie wavelength? Write down the formula used. [Answer](#)
17. How will you increase the penetrating power of X-rays produced in an X-ray tube? [Answer](#)
18. The half-life of radon is 3.8 days. Calculate the amount of radon left undecayed in a sample containing 1024 mg of radon after 38 days. [Answer](#)
19. The energy of an electron in the first Bohr orbit of an atom is -27.2 eV. What will be the energy in the third orbit? [Answer](#)
20. Explain why the electrical conductivity of a pure semiconductor increases on heating. [Answer](#)
21. An electric dipole is placed in a uniform external electric field $\mathbf{E}$. Show that the torque acting on the dipole is given by $\boldsymbol{\tau} = \mathbf{p} \times \mathbf{E}$, where $\mathbf{p}$ is the dipole moment. [Answer](#)
22. A potential difference of V volt is applied across a copper wire of length l and diameter d . How will the drift velocity be affected if
(i) V is double (ii) l is doubled. [Answer](#)
23. State Biot-Savart law. Derive an expression for magnetic field at the centre of a circular current carrying coil of radius r . [Answer](#)
24. Distinguish between diamagnetic and paramagnetic substance in terms of its relative permeability (μ_r) and magnetic susceptibility (χ). [Answer](#)
25. A current of 4A flows in a coil when connected to a 12 V dc source. If the same coil is connected to a 12 V, 8 Hz ac source, a current of 2.4 A flows in the coil. Calculate the inductance of the coil. [Answer](#)
26. In the diagram given below (figure), find the current drawn from the battery:



- (i) just when the switch S is closed.
(ii) when sufficient time has elapsed after closing the switch.

[Answer](#)

27. Microwaves, X-rays, U.V. rays, infrared rays.
Which of the above electromagnetic waves has—

(i) the shortest wavelength.

(ii) the lowest frequency.

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28. Derive Snell's law of refraction using Huygen's principle. [Answer](#)
29. In a Young's double slit experiment with monochromatic light, fringes are obtained on a screen placed at a distance D from the slits. If the screen is moved by 5×10^{-2} m towards the slits, the change in the fringe width is 3×10^{-5} m. If the distance between the slits is 10^{-3} m, calculate the wavelength of the light used. [Answer](#)
30. In a single slit diffraction pattern how does the angular width of central maximum change, when
- the slit width is increased.
 - light of smaller wavelength is used.
- [Answer](#)
31. Define dispersive power of the material of a prism. The refractive indices of a prism for violet, yellow and red colours are 1.632, 1.620 and 1.613 respectively. Calculate the dispersive power of the material of the prism. [Answer](#)
32. A convex lens and a plane mirror are kept at a distance of 10 cm as shown in the diagram. Parallel rays incident on the convex lens after reflection from the mirror form an image at the optical centre. Complete the ray diagram and find out the focal length of the lens. [Answer](#)
33. Explain why light waves can be polarised but sound waves cannot. Describe a method by which a plane polarised light can be distinguished from a partially polarised light. [Answer](#)
34. Sunglasses have curved surfaces, but their power is zero. Why ? [Answer](#)
35. Define magnifying power of an optical instrument. An astronomical refracting telescope consists of two lenses of focal length 75 cm and 5 cm. Calculate the magnifying power of the telescope when the final image is formed at a distance of 25 cm from the eye. [Answer](#)
36. What is Compton scattering ? Mention the important conclusion drawn from the phenomenon of Compton scattering. [Answer](#)
37. The threshold wavelength of tungsten is 2400 Å.
- When tungsten is illuminated with light of wavelength 1600 Å, find :
- Work function
 - Maximum kinetic energy of the emitted electron
 - Stopping potential.
- [Answer](#)
38. In a Thomson set-up for finding e/m , the electrons are accelerated through a potential difference of 2500 V. The electrons then enter a region of crossed electric and magnetic fields of magnitudes 3.6×10^4 V/m and 1.2×10^{-3} T respectively and pass through undeviated. Calculate the e/m of an electron. [Answer](#)
39. In a hydrogen atom a transition of electrons take place from 3rd orbit to 2nd orbit. Calculate the wavelength of the emitted photon. To which spectral series will this photon belong ? [Answer](#)
40. Define half-life of a radioactive substance. Establish a relationship between half-life T and decay constant λ . [Answer](#)

41. Why are neutrons considered as ideal particles for nuclear fission reactions ? Calculate the energy released in the following nuclear reaction.

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 ${}_1\text{H}^2 + {}_1\text{H}^2 \rightarrow {}_2\text{He}^4 + \text{energy}$

(mass of ${}_1\text{H}^2 = 2.014102 \text{ u}$, mass of ${}_2\text{He}^4 = 4.002604 \text{ u}$).

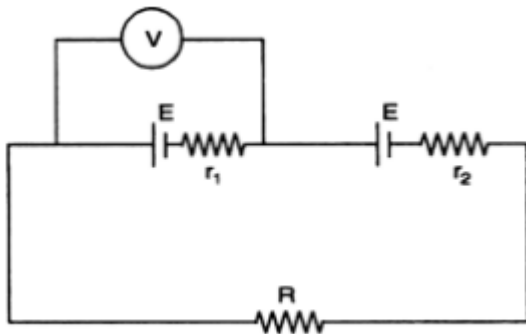
Answer

42. What is LED ? Explain how radiations are given out by LED. [Answer](#)
43. The output of a OR gate is connected to a NOT gate as shown in the figure given below. Name the new gate formed. Draw the logic symbol and truth table of the new gate. [Answer](#)



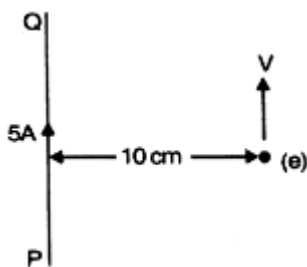
Long Answer Type

44. Two cells of same e.m.f. E , but different internal resistance r_1 and r_2 are connected to an external resistance R as shown in the figure. The voltmeter V reads zero. Obtain an expression for R in terms of r_1 and r_2 . Calculate the voltage across the cell of internal resistance r_2 . (Assume that the voltmeter V is of infinite resistance).



Answer

45. In the figure given below, PQ is a long straight wire carrying a current of 5A in the direction of the arrow. An electron travels with a velocity of 10^6 m/s at a distance 10 cm from the wire in the same direction of the current. Calculate the magnitude and direction of the force experienced by the electron.



Answer

46. Explain with necessary formula (no derivation) how you will compare the magnetic moments of two magnets by equal distance method using a deflection magnetometer in tan A position.
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Answer

47. (i) With proper labelling of the axis, draw the input and output characteristic curves of a npn transistor in common emitter configuration.
- (ii) Define current gain for a transistor in common emitter configuration.

Answer