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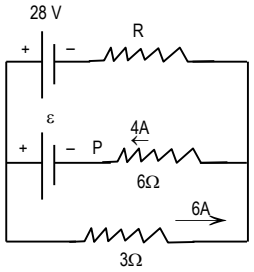
Dashain Assignment 2074

Physics - XII

SET A

Short Questions

1. What are the importance of millikan's oil drop experiment?
2. An electron and a proton move with the same speed in a uniform magnetic field of equal magnitude, compare the radii of their circular path.
3. If the frequency of incident light is doubled, would the kinetic energy of the ejected photo electron also doubled?
4. Electron cannot exist inside the nucleus, why?
5. Distinguish between spontaneous and stimulated emission with diagram.
6. What are cathode rays? Why are they not regarded as electromagnetic wave?
7. You are given n wires each of resistance RΩ what is the ratio of maximum to minimum resistance that can be obtained from these wires?
8. Batteries are always labelled with their emf. Would it also be appropriate to put a label on batteries stating how much current they provide? Why or why not?
9. Why do we prefer a potentiometer to measure emf of a cell rather than a voltmeter?
10. Write down the significance of Kirchhoff's law.
11. Ammeters are always connected in series, why?
12. Two bulbs of 60 watt and 100 watt are connected in series and this combination is connected across the mains. Which bulb will glow more brightly?



13. One of the 'Nine Jewels' of Emperor Akbar, widely known as Tansen, the king of music was able to break a glass by singing the appropriate note. What physical phenomenon could account for this?
14. If the frequency of a fundamental note of a closed pipe and that of an open pipe are the same, what will be the ratio between their lengths?
15. Is it possible to convert a plane wave front into a spherical wave front or vice-versa? Explain.
16. What are the advantages of measuring speed of light?

Long Questions

1. Discuss the mechanism of metallic conduction. Derive J = nev, where J is current density, e is electronic charge and v is drift velocity.
2. What do you mean by a shunt? Describe its use in converting a galvanometer into an ammeter.
3. State and explain joule's laws of heating effect of electric current. Discuss how they are verified experimentally.
4. Discuss the principle of potentiometer and use it to determine the internal resistance of a cell.
5. Explain the phenomenon of discharge of electricity through gases at low pressure.
6. Show that the motion of an electron in uniform magnetic field is circular. Prove that time period and frequency are independent with the velocity of an electron.
7. Describe Millikan's experiment to verify Einstein's photoelectric equation.
8. What are Bohr's postulates of hydrogen atom? Derive an expression for the radius of Bohr's nth orbit.
9. What is progressive wave? Derive the expression of progressive wave interms of wave vector and frequency.
10. What are organ pipes? Show that both even and odd harmonics present in open organ pipe.
11. Describe Michelson's method to determine the speed of light.
12. What is wave front? Verify the laws of refraction of light.

Numerical

1. In the adjacent circuit find
   i. the current is Resistor R
   ii. Resistance R
   iii. the unknown emf ε
   iv. if the ckt is broken at p, what is the current in resister R?
2. i. Resistance of a wire of length 1m, diameter 1 mm is 2.2 Ω. Calculate its resistivity and conductivity.
   ii. A 2 ohm resistance coil is to be constructed from a wire of diameter 0.315 mm. If the resistivity of constantan is 49×10^{-6} Ω cm, find the length of the wire required to constructed the coil.
3. The driver cell of a potentiometer has an emf of 2 volt and negligible internal resistance. The potentiometer wire has a resistance of 3Ω. Calculate the resistance needed in series with, the wire if a p.d. of 5 mv is required across the whole wire. The wire is 100 cm long and a balance length of 60 cm is obtained for a thermocouple emf E. What is the value of E?

4. In a Millikans-type apparatus the horizontal plates are 1.5 cm apart with the electric field switched off an oil drop is observed to fall with the steady velocity 2.5×10^{-2} cmS^{-1}. When the field is switched on the upper plate being positive, the drop just remains stationary when the potential difference between the plates is 1500 V. Calculate the radius of the drop and the number of electronic charges. [Given, density of oil = 900 kg m^{-3} and viscosity of air = 1.8×10^{-5} Nsm^2, neglect air density.)
5. Cesium has a work function of 1.9 eV find (a) threshold wavelength (b) Maximum energy of the liberated electrons. When the metal is illuminated by light of wavelength 4.5×10^{-7} m (c) What is the stopping potential.
6. An electron of energy 20 ev comes into collision with a hydrogen atom in its ground state. The atom is excited into a higher state and the electron is scattered with reduced velocity. The atom subsequently returns to its ground state with the emission of photon of wavelength 1.216×10^{-7} m. Determine the velocity of the scatted electron. (mass of electron = 9.1×10^{-31} kg)
7. When a detonator is exploded on a railway line, an observer standing on the rail 2 km away hears two sounds. What is the time internal between them? [$Y_{steel} = 2\times10^{11}$ Nm^{-2}, $\rho_{steel} = 8\times10^3$ kgm^{-3}, ρ_{air} = 1.4 kg m^{-3}, n = 1.4 and atmospheric pressure = 10^5 Nm^{-2}]
8. The radius of curvature of the curved mirror is 200 m and the plane mirror is rotated at 20 rev s^{-1}. Calculate the angle in degree between a ray incident on the plane mirror and then reflected from it after the light has travelled to the curved mirror and back to the plane mirror ($c = 3\times10^8$ ms^{-1})

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Physics - XII

SET B

Short Questions

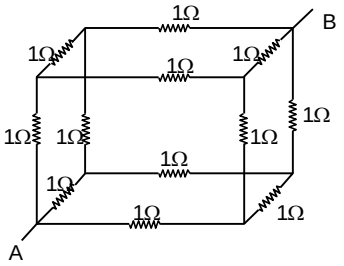
1. A proton and an electron moving with the same velocity are subjected to an electric field. Which one gain more energy and why? What about velocity?
2. The value of e/m is constant for cathode rays, but not for the +ve rays, explain.
3. Why does the maximum velocity of photoelectron not depend upon the intensity of radiation?
4. An electron is in the third excited state. How many different photon, wavelengths are possible?
5. A proton and an electron have the same kinetic energy. Which has longer de-Broglie wavelength?
6. What are necessary conditions for lasing action? Explain about population inversion and optical pumping.
7. Two copper wires of different diameters are joined end-to-end. If a current flows in the wire combination, what happens to the drift velocity of the electrons when they move from the wire having larger diameter to the smaller one?
8. Is terminal p.d. across a battery be greater than its emf, explain.
9. How would you convince that the principle of measurement of wire by meter bridge is based on wheatstone bridge principle? Explain.
10. If the length of the wire be doubled. What will be the effect on the position of zero deflection in a potentiometer?
11. You are given a conducting wire of resistance R, it is cut into two equal halves at constant temperature, what is the ratio of maximum to minimum equivalent resistance obtain from possible combination?
12. When a motor car is started its light becomes slightly dim. Why?
13. Bells are made of metals, not of wood, why?
14. Why velocity of sound is greater in hydrogen gas than other gases?
15. State Huygen's principle. Does it apply to sound wave in air?
16. When monochromatic light incidents on a surface, the reflected and refracted wave will have same frequency. Why?

Long Questions

1. State and explain Ohm's law. How would you verify it experimentally?
2. Distinguish between resistance and resistivity. How a galvanometer is converted into a voltmeter?
3. What is the difference between on electromotive force and the terminal potential difference? How are they related?
4. What is a wheatstone bridge? Obtain the balanced condition for the bridge. Explain how resistance can be measured by a meter bridge.
5. Discuss the principle of potentiometer and use it to compare the emf's of two cells.
6. Describe the necessary theory. Millikan's oil drop experiment to determine the value of the charge associated with an electron.
7. What is specific charge of an electron? Describe and give necessary theory of J. J. Thomson's method to determine the specific charge of an electron.
8. What is photoelectric effect? Derive Einstein's photoelectric equations, and define various terms used in it.
9. Starting from Bohr's postulates, obtain an expression for the energy of the electron in nth orbit of the hydrogen atom.
10. State superposition principle and use it to show the distance between any two consecutive nodes or antinodes are equal and half of wavelength.
11. What is Newton's formula of velocity of sound in air? What correction was made by Laplace?
12. Describe focault method to determine the speed of light, also list out its demerits.
13. What is Huygen's principle? Use it to verify the laws of reflection of light.

Numerical

1. A battery of emf 24 v and internal resistance r is connected to a circuit having two parallel resistors of 3Ω and 6Ω is series with an 8Ω resistor. The current flowing in 3Ω resistor is then 0.8A.
   Calculate (i) the current in the 6Ω resistor (ii) internal resistance r (iii) the terminal p.d. of the battery.
2. Twelve resistors each of resistance 1Ω are connected as in fig. A battery of emf 6V and negligible internal resistance are connected across the network of resistors A and B. Find equivalent resistance and current flowing through the battery.



3. The emf of a battery A is balanced by a length of 75.0 cm on a potentiometer wire. The emf of a standard cell. 1.02 v is balanced by a length of 50.0 cm.

What is the emf of A? Calculate the new balance length if A has an internal resistance of 2Ω and a resistance 8Ω is joined to its terminals.

4. A beam of electrons, moving with a velocity of 10^6 ms^{-1} enters midway between two horizontal parallel plates in a direction parallel to the plates. Each plate is 4 cm long. These plates are kept 2 cm apart and a potential difference V is applied between them. Calculate V if the beam is deflected so that it just grazes the edge of positive plate. [$\frac{e}{m} = 1.8 \times 10^{11}$ ckg^{-1}]

5. When light of frequency 5.4×10^{14} Hz is incident on to a metal surface, the minimum energy of the electron emitted is 1.2×10^{-19}J. If the same surface is illuminated with light of frequency 6.6×10^{14} Hz the maximum energy of the electrons emitted is 2.0×10^{-14} J. Use this data to calculate a value of planck's constant.

6. Calculate the wavelength of the first line of the Balmer series, if the wavelength of the second line of this series is 4.86×10^{-7} m.

7. A sonometer wire is stretched by hanging a metal cylinder of density 8000 kg m^{-3} at the end of the wire. A fundamental note of frequency 256 Hz is sounded when the wire is plucked. Calculate the frequency of vibration of the same length of wire when a vessel of water is placed so that the cylinder is totally immersed.

8. A beam of light after reflection at a plane mirror, rotating 2000 times per minute passes to a reflecting mirror, placed 6255 m away from the rotating mirror. It returns to the rotating mirror from which it is reflected to make an angle of 1° with its original direction. Calculate the velocity of light.