Class : XII || AHSEC || Pre Board Examination , 2024-25
Subject : Physics ||Full marks : 70||Time : 3hours|| Set - 03

(The figures in the margin indicate full marks for the questions)

Each of the following questions carries 1 mark each -

1.The total electric flux through the faces of the cube with side of length 'a' if a charge q is placed at the centre of the cube is
(a) $q/8\varepsilon_0$ (b) q/ε_0 (c) $q/6\varepsilon_0$ (a) $q/4\varepsilon_0$

2. If n cells each of emf ε and internal resistance r are connected in parallel, then the total emf and internal resistance will be
(a) ε , r/n (b) ε , nr (c) nε , r/n (d) nε , nr

3. cutting a bar magnet into half is like cutting a solenoid. We get two smaller solenoids
(a) with stronger magnetic properties.
(b) with weaker magnetic properties.
(c) with semi magnetic properties. (d) none of these.

4. A transformer is employed to
(a) Obtain a suitable dc voltage (b) Convert dc into ac
(c) Obtain a suitable ac voltage (d) Convert ac into dc

5. 1eV is energy acquired by an electron when it is accelerated through potential difference of –
(a) 1 V (b) 10 V (c) 0.1 V (d) none of these

6. In a coil of self-induction 5 H, the rate of change of current is 2 A/s. Then emf induced in the coil is
(a) 10 V (b) 5 V (c) −5 V (d) −10 V

7. By what factor must the mass number change for the nuclear radius to become twice?
(a) 3^3 (b) 4^3 (c) 2^3 (d) 5^3

8.The spacing between field lines indicates its _____
(a)charge (b)position (c)strength (d) none of above

Each of the following questions carries 2 mark seach -

9: The maximum current that can be measured by a galvanometer of resistance 40 Ω is 10 mA . It is converted into voltmeter that can read upto 50 V. Find the resistance to be connected in the series with the galvanometer .

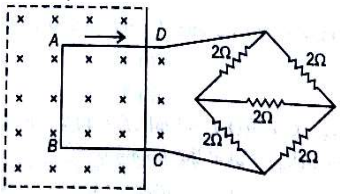
10. In the circuit diagram shown, R = 10 Ω , L = 5 mH , E = 10 V and ***i*** = 1A. The current is decreasing at the rate of 10^3 A/s. Then find $V_A - V_B$ at this instant is

11. A plane electromagnetic wave travels in vacuum along z-direction. What can you say about the directions of its electric and magnetic field vectors? If the frequency of the wave is 30 MHz, what is its wavelength?

Or

The oscillating electric field of an electromagnetic wave is given by:
$E = 30 \sin [2 \times 10^{11} t + 300 \pi x]$ Vm^{-1}
(a) Obtain the value of the wavelength of the electromagnetic wave.
(b) Write down the expression for the oscillating magnetic field.

12. A metallic square loop ABCD of size 15 cm and resistance 1.0 Ω is moved at a uniform velocity of v m/s, in a uniform magnetic field of 2 T, the field lines being normal to the plane of the paper. The loop is connected to an electrical network of resistors, each of 2 Ω. Find the speed of the loop, for which 2 mA current flows in the loop.



13. State Bohr's quantisation condition of angular momentum. Calculate the shortest wavelength the Brackett series and state to which part of the electromagnetic spectrum does it belong.

Or

Calculate the orbital period of the electron in the first excited state of hydrogen atom.

14 .Violet light is incident on a converging lens of focal length f. State with reason, how the focal length of the lens will change, if the violet light is replaced by red light.

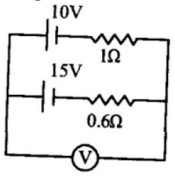
Or

(a)Obtain relation between critical angle between & refractive index.
(b) A convex mirror is immersed in water of refractive index 1.33. Will the lens behave as a converging or a diverging lens? Give reason.

15. Answer the following.
(a) Why do Ge and Si behave as semiconductors?
(b) Draw IV characteristics of PN junction diode .

16: An electron, an alpha particle, a deutron and a proton have the same KE. Which one has shortest de Broglie wavelength?

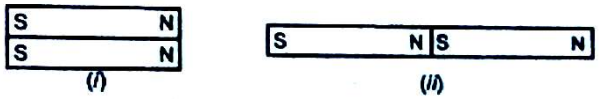
17:A 10 V battery with internal resistance 1Ω and a 15V battery with internal resistance 0.6Ω are connected in parallel to a voltmeter as shown in the figure. The reading in the voltmeter will be close to



18: Name the parts of the electromagnetic spectrum which is
(i) Suitable for RADAR systems in aircraft navigations.
(ii) Used to treat muscular strain.
(iii) Used as a diagnostic tool in medicine. Write in brief, how these waves can be produced?
(iv) Used in cooking ,

Each of the following questions carries 3 marks each -

19. (a) Calculate the force per unit length acting between two parallel wires of infinite extent separated by a distance 2 cm each carrying current of 4 A .
(b) Two identical bar magnets of magnetic dipole moment M each are arranged as shown in the figure (i) and figure (ii).



What will be the dipole moment in each case?

20. (a) Draw the ray diagram showing the formation of image by a reflecting type telescope .
(b)Give the difference between reflecting type and refracting type telescope .

Or

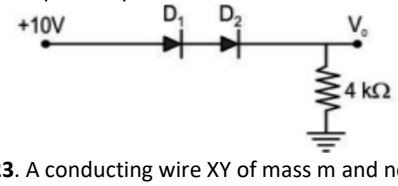
Find the equivalent focal length of the combination of two thin lenses in contact .

21. What Q value of a nuclear reaction ?
If the fission of a $_{26}Fe^{56}$ nucleus into two equal fragments, $_{13}Al^{28}$. Is the fission energetically possible? Argue by working out *Q* of the process. Given *m* ($_{26}Fe^{56}$) = 55.935 u and *m* ($_{13}Al^{28}$) = 27.982 u.

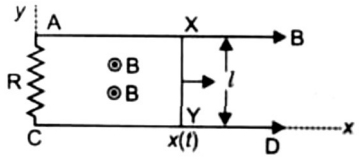
Or

Using the curve for the binding energy per nucleon as a function of Mass number A, state clearly how the release of energy in the processes of nuclear fission and nuclear fusion can be explained.

22.The threshold voltage for diodes D_1 and D_2 are 0.3 V and 0.7 V respectively. Determine current in the circuit.Find V_0



23. A conducting wire XY of mass m and negligible resistance slides smoothly on two parallel conducting wires as shown in figure. The circuit has a resistance R due to AC. AB and CD are perfect conductors. There is a magnetic field B =B(t) $\hat{k}$



(a) Write down equation for emf induced in the wire XY.
(b) Give the expression for current flowing through R .

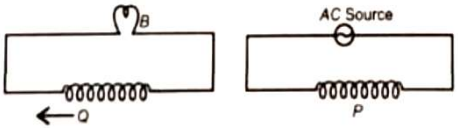
Or

Find the expression for mutual inductance for pair of coaxial solenoids.

24. The primary coil of an ideal step-up transformer has 100 turns and the transformation ratio is also 100. The input voltage and power are 220 V and 1100 W respectively. Calculate
(a) number of turns in the secondary coil
(b) the current in the primary coil and secondary coil
(c) voltage across the secondary coil
(d) power in the secondary coil

Or

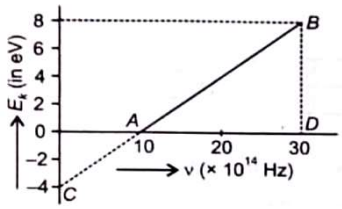
A coil Q is connected to low voltage bulb B and placed near another coil P as shown below . Give reasons to explain the following observations:



(a) The bulb B lights
(b) Bulb gets dimmer if the coil Q is moved towards left.

25. (a) Draw the intensity pattern for single slit diffraction and double slit interference.
(b) State two differences between interference and diffraction patterns.

26. (a) Given below is the graph between frequency (**ν**) of the incident light and maximum kinetic energy (E_k) of emitted photoelectrons. Find the values of (i) threshold frequency and (ii) work function from the graph.



(b) In photoelectric effect, why should the photoelectric current increases as the intensity of monochromatic radiation incident on a photosensitive surface is increased? Explain.

Or

Draw properly labelled graphs to show the following concerning photo electric emission:
(a) Variation of photo electric current with the intensity of radiation.
(b) Variation of photo electric current with accelerating and stopping potential.
(c) Variation of stopping potential with frequency of incident radiation

27. (a) Using postulates of Bohr's theory of hydrogen atom, show that
(i) the radii of orbits increase as n^2 , and
(ii) the total energy of the electron increases as l/n^2 , where n is the principal quantum number of the atom.
(b) Calculate the wavelength of H_α line in Balmer series of hydrogen atom, given Rydberg's constant R = 1.0947 x 10^7 m^{-1}.

Section E [Each question carries 5 marks]

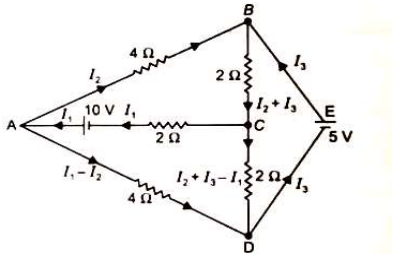
28.(a) Define the term 'electrostatic potential'.
Find an expression for the electrostatic potential due to an electric dipole at a point .
(b) Explain why electrostatic potential inside a charged hollow sphere is zero .

Or

(a) Define the capacitance of a capacitor. Obtain the expression for the capacitance of a parallel plate capacitor in vacuum in terms of plate area A and separation d between the plates d .
(b) What will be the expression for the capacitance of the parallel plate capacitor if a dielectric slab of thickness t (t < d) is introduced between the plates of capacitor.

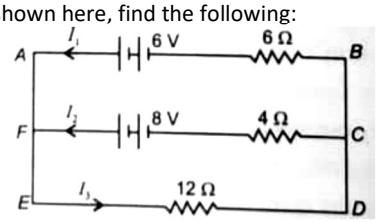
29. (a) State Kirchhoff's rules for electrical circuits with diagrams.

(b)Determine the current in each branch of the network shown below



Or

In the network shown here, find the following:



(a) Currents I_1, I_2 and I_3
(b) Terminal potential difference of each battery.
Consider 6 Ω to be the internal resistance of 6 V battery and 4 Ω to be internal resistance of 8 V battery.

30. (a) Draw a ray diagram of compound microscope. Write the expression for its magnifying power.

(b) A compound microscope consists of an objective lens of focal length 2.0 cm and an eyepiece of focal length 6.25 cm separated by a distance of 18 cm. How far from the objective lens should an object be placed in order to obtain the final image at the least distance of distinct vision (25 cm)? Find the magnifying power of the microscope.

Or

(a) Draw the diagram showing the formation of dark and bright fringes in the Young's double slit experiment. Hence write the expression for the fringe width.
(b)What are the criteria for obtaining interference fringes on a seen ?
(c) Is the phenomenon of interference of light in accordance with the law of conservation of energy? Justify.

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