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PRE-BOARD EXAMINATION 2022-23

CLASS: XII SUBJECT: PHYSICS

TIME: 3HRS MAX. MARKS: 70

General Instructions:

(i) All questions are compulsory. There are 35 questions in all.

(ii) The question paper has 5 sections Section A, Section B, Section C, Section D & Section E

(iii) Section A contains eighteen questions of 1mark each. Section B has seven questions 2 marks each, Section C has five questions 3 marks each, Section D has three questions of 5 marks each and Section E contains 2 case study based questions of 4 marks each.

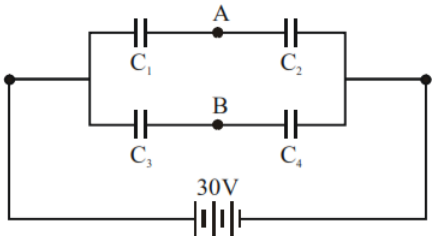
(iv) There is no overall choice. However an internal choice has been provided Section B,C &,D

SECTION A

1. Force between A and B is F. If 75% charge of A is transferred to B then forcebetween A and B is

i) F/ 4
ii) 4F
iii) F
iv) None

2. Four capacitors with capacitances C1= 1μF, C2 = 1.5 μF, C3 = 2.5 μF andC4 = 0.5 μF are connected as shown and are connected to a 30 V source. The potential difference between points B and A is?



i) 5V
ii) 9 V
iii) 10 V
iv) 13 V

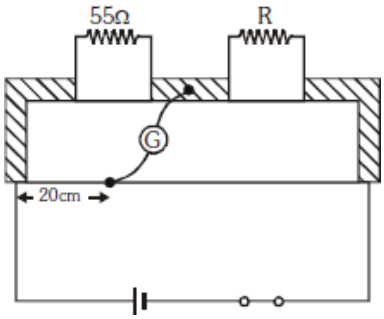
3. Which of the following statements is correct for diamagnetic materials:
   i) μ r < 1
   ii) x is negative and low
   iii) x does not depend on temperature
   iv) All of the above

4. A current of 3 amp is flowing in a plane circular coil of radius 4 cm and number of turns 20. The coil is placed in a uniform magnetic field of magnetic induction 0.5 tesla. Then, the dipole moment of the coil is-
   i) 3000 A-m^2
   ii) 0.3 A-m^2
   iii) 75 A-m^2
   iv)300 A-m^2

5. A circular current loop of magnetic moment M is in an arbitrary orientation in an external magnetic field B. The work done to rotate the loop by 30° about anaxis perpendicular to its plane is
   i) MB
   ii) $\sqrt{3}/2$MB
   iii)1/2MB

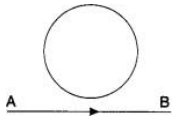
iv) zero

6. Shown in the figure below is a meter - bridge set up with null deflection in the galvanometer. The value of R is :



i) 13.75 Ω
ii) 220 Ω
iii) 110 Ω
iv) 55 Ω

7. In the given figure current from A to B in the straight wire is decreasing. The direction of induced current in the loop is A:



i) clockwise
ii)anti clockwise
iii) changing
iv)none

8 The nature of electromagnetic wave is-
i) Longitudinal
ii) Longitudinal stationary
iii)Transverse
iv)Transverse stationary

9. The work function of Caesium is 2.14 eV. Find the wavelength of the incident light if the photo current is brought to zero by a stopping potential of 0.60 V
i) 454 nm
ii) 640 nm
iii) 540 nm
iv) None of these

10. In YDSE the separation between the slits is halved and the distance betweenslit and the screen is doubled. The fringe width is-
i)unchanged
ii) halved
iii) doubled
iv) four times

11. When boron ${}_5B^{10}$ is bombarded by neutron, alpha-particles is emitted. Theresulting nucleus has the mass number
i) 11
ii) 7
iii) 6
iv)15

12. A coil of self-inductance L is connected in series with a bulb B and an acsource. Brightness of the bulb decreases when
i)frequency of the ac source is decreased.
ii)number of turns in the coil is reduced.

iii)a capacitance of reactance Xc = XL in included.
iv)an iron rod is inserted in the coil

13. In nuclear reactors, the control rods are made of
i)cadmium
ii) graphite
iii) krypton
iv) plutonium

14. Two capacitors of capacitance 6 μF and 4 μF are put in series across a 120 V battery. What is the potential difference across the 4 μF capacitor ?
i) 72 V
ii) 60 V
iii) 48 V
iv) zero

15. Two parallel metal plates having charges + Q and – Q face each other at a certain distance between them. If the plates are now dipped in kerosene oil tank, the electric field between the plates will-
i) Increase
ii)Decrease
iii)Remain same
iv)Become zero

16.Two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (1),(2), (3) and (4) as given below.
(1) Both A and R are true and R is the correct explanation of A
(2) Both A and R are true and R is NOT the correct explanation of A
(3) A is true but R is false
(4) A is false and R is also false
Assertion: Kirchhoff's junction rule follows from conservation of charge.
Reason : Kirchhoff's loop rule follows from conservation of momentum

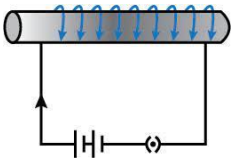
17. Two statements are given-one labelled Assertion (A) and the other labelledReason (R). Select the correct answer to these questions from the codes (1),(2), (3) and (4) as given below.
(1) Both A and R are true and R is the correct explanation of A
(2) Both A and R are true and R is NOT the correct explanation of A
(3) A is true but R is false
(4) A is false and R is also false
Assertion In interference, different maxima have same intensities.
Reason In diffraction phenomenon, different maxima have differentintensities.

18. Two statements are given-one labelled Assertion (A) and the other labelledReason (R). Select the correct answer to these questions from the codes (1),(2), (3) and (4) as given below.
(1) Both A and R are true and R is the correct explanation of A
(2) Both A and R are true and R is NOT the correct explanation of A
(3) A is true but R is false
(4) A is false and R is also false
Assertion If distance of the point source is increased from the photoelectricplate, then stopping potential will remain unchanged.
Reason Saturation current will decrease.

SECTION B

19. Identify the electromagnetic waves whose wavelengths vary as(a) 10^{-12}m < λ < 10^{-8} m (b) 10^{-3} m < λ< 10^{-1} m.
Write one use for each.

20. Draw the magnetic field lines for a current carrying solenoid when a rod madeof (a) copper, (b) aluminium and (c) iron are inserted within the solenoid as shown.



21. Calculate the de-Broglie wavelength of the electron orbiting in the n = 2 state of hydrogen atom.

OR

The kinetic energy of the electron orbiting in the first excited state of hydrogenatom is 3.4 eV. Determine the de Broglie wavelength associated with it.

22. What is the focal length of a convex lens of focal length 30 cm in contact with aconcave lens of focal length 20 cm? Is the system a converging or a diverging lens? Ignore thickness of the lenses.

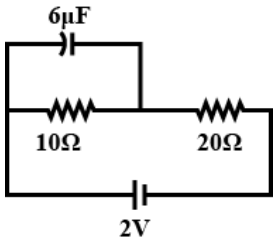
23. Draw energy band diagrams of an n-type and p-type semiconductor at temperature T > 0 K. Mark the donor and acceptor energy levels with theirenergies

OR

How is forward biasing different from reverse biasing in a p-n junction diode?

24. Fringe width in a particular YDSE is measured to be b. What will be the fringewidth, if wavelength of the light is doubled, separation between the slits is halved and separation between the screen and slits is tripled?

25. Find the charge on the capacitor as shown in the circuit



SECTION C

26. The ground state energy of hydrogen atom is -13.6 eV.

(i) What is the potential energy of an electron in the 3rd excited state?

(ii) If the electron jumps to the ground state from the 3rd excited state, calculate the wavelength of the photon emitted.

27. Find the frequency of light which ejects electrons from a metal surface, fullystopped by a retarding potential of 3.3 V. If photoelectric emission begins in this metal at a frequency of $8X10^{14}$ Hz, calculate the work function(in eV) for this metal.

OR

Light of same wavelength is incident on three photosensitive surfaces A, B andC.

The following observations are recorded.

From surface A, photoelectrons are not emitted.

From surface B, photoelectrons are just emitted.

From surface C, photoelectrons with some kinetic energies are emitted.Compare the threshold frequencies of the three surfaces and justify your

28. In a series LCR circuit, obtain the conditions under which the impedance of the circuit is minimum, and wattless current flows in the circuit.

OR

Draw the graphs showing variation of inductive reactance and capacitivereactance with frequency of applied ac source. Can the voltage drop across the inductor or the capacitor in a series LCR circuit be greater than the applied voltage of the ac source? Justify your answer.

29. The figure shows a series LCR circuit with L = 5.0 H, C = 80 μF, R = 40 Ω connected to a variable frequency 240 V source. Calculate

(i) The angular frequency of the source which drives the circuit at resonance.

(ii) The current at the resonating frequency.

(iii) The rms potential drop across the capacitor at resonance

OR

Explain the principle on which the metal detector is used at airports for security reasons.

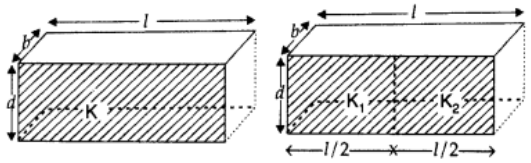
30. A rectangular coil of sides 'V and 'b' carrying a current I is subjected to a uniform magnetic field B→ acting perpendicular to its plane. Obtain the expression for the torque acting on it.

SECTION D

31. (a) Derive an expression for the electric field E due to a dipole of length '2a' at a point distant r from the centre of the dipole on the axial line. (b) Draw a graph of E versus r for r >> a.
(c) If this dipole were kept in a uniform external electric field diagrammatically represent the position of the dipole in stable and unstable equilibrium and write the expressions for the torque acting on the dipole in both the cases.

OR

Obtain the expression for the potential due to an electric dipole of dipole moment p at a point V on the axial line.
(b) Two identical capacitors of plate dimensions l × b and plate separation d have di-electric slabs filled in between the space of the plates as shown in the figure.



Obtain the relation between the dielectric constants K, K_1 and K_2.
32. a) State Kirchhoff's rules for an electric network. Using Kirchhoff's rules, obtain the . balance condition in terms of the resistances of four arms of Wheatstone bridge.
(b) In the meter bridge experimental set up, shown in the figure, the null point 'D' is obtained at a distance of 40 cm from end A of the meter bridge wire. If a resistance of 10 Ω is connected in series with R_1, null point is obtained at AD = 60 cm. Calculate the values of R_1 and R_2

OR

Derive the relation between current density 'J→' and potential difference 'V' across a current carrying conductor of length area of cross-section 'A' and the number density of free electrons. Estimate the average drift speed of conduction electrons in a copper wire of cross-sectional area 1.0×10^{-7} m^2 carrying a current of 1.5 A.
33. (a) Deduce the expression, by drawing a suitable ray diagram, for the refractive index of triangular glass prism in terms of the angle of minimum deviation (D) and the angle of prism (A).
Draw a plot showing the variation of the angle of deviation with the angle of incidence.
(b) Calculate the value of the angle of incidence when a ray of light incident on one face of an equilateral glass prism produces the emergent ray, which just grazes along the adjacent face. Refractive index of the prism is √2

OR

34. (a) Define wavefront. Use Huygens' principle to verify the laws of refraction.
(b) Based on Huygen's construction, draw the shape of a plane wavefront as it gets refracted on passing through a convex lens Prism

SECTION E

34. **Case Study: Full Wave Rectifier**

Read the following paragraph and answer the questions.
The process of converting alternating voltage/current into direct voltage/current is called rectification. Diode is used as a rectifier for convertingalternating current/voltage into direct current/voltage. Diode allows current to pass only, when it is forward biased. So, if an alternating voltage is applied acrossa diode, the current flows only in that
part of the cycle when the diode is forward biased. This property is used torectify the current/voltage.

i) For what purpose rectifiers are used?
ii) What do you mean by rectification?
iii) Which property of diode is used in rectification?
iv) For convert fluctuating DC into constant amplitude DC which components are used?

35. **Case Study: Optical Fibre**

Read the following paragraph and answer the questions.

Optical fibre works on the principle of total internal reflection. Light rays can beused to transmit a huge amount of data, but there is a problem here – the lightrays travel in straight lines. So, unless we have a long straight wire without any bends at all, harnessing this advantage will be very tedious. Instead, the optical cables are designed such that they bend all the light rays' inwards (using TIR).
Light rays travel continuously, bouncing off the optical fibre walls andtransmitting end to end data. It is usually made of plastic or glass Modes of transmission: Single-mode fibre is used for long-distance transmission, while multi-mode fiber is used for shorter distances. The outercladding of these fibres needs better protection than metal wires. Although light signals do degrade over progressing distances due to absorption and scattering. Then, optical Regenerator system is necessary to boost the signal.Types of Optical Fibres: The types of optical fibers depend on the refractive index, materials used, and mode of propagation of light. The classification based on the refractive index is as follows:
Step Index Fibres: It consists of a core surrounded by the cladding, which has asingle uniform index of refraction.
Graded Index Fibres: The refractive index of the optical fibre decreases as theradial distance from the fibre axis increase

i) On what principle optical fibres works?
ii) For long distance transmission which mode of fibre is used?
iii) What is the refractive index of core and cladding?
iv) Give the name of two types of optical fibres.