I–PRE BOARD EXAMINATION : 2022-23

CLASS : XII

PHYSICS PAPER–1 (THEORY)

(Maximum Marks : 70)

(Time allowed : Three hours)

Candidates are allowed an additional 15 minutes for only reading the paper.

They must NOT start writing during this time.

This question paper is divided into four Sections A, B, C and D.

All questions are compulsory.

Section-A consists of one questions having sub parts of one marks each.

Section-B consists of seven questions of two marks each.

Section-C consists of nine questions of three marks each and

Section-D consists of three questions of five marks each.

Internal choices have been provided in two questions each in Section-B, Section-C and Section-D.

The intended marks for questions are given in brackets [ ].

All working, including rough work, should be done on the same sheet as and adjacent to the rest of the answer.

Answers to sub parts of the same question must be given in one place only.

A list of useful physical constants is given at the end of this paper.

A simple scientific calculator without a programmable memory may be used for calculations.

SECTION- A [14 MARKS]

Question 1

(A) In questions (i) to (vii), choose the correct alternative (a), (b), (c) or (d) for each of the questions given below :

(i) Two charged metallic spheres having radii R_1 and R_2 are brought into contact. What will be the ratio of their final surface charge densities : [1]

(a) $\frac{R_1}{R_2}$

(b) $\frac{R_2}{R_1}$

(c) $R_1 R_2$

(d) 1 : 1

(ii) A wire of resistance R is cut in to n equal parts and these parts are then connected in parallel combination. The equivalent resistance of the combination is : [1]

(a) nR

(b) $\frac{R}{n}$

(c) $\frac{n}{R^2}$

(d) $\frac{R}{n^2}$

(iii) Which of the following is reverse biased p-n junction diode, conducting electricity when placed in illuminated room : [1]

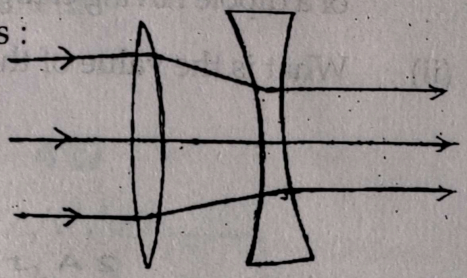
(a) LED

(b) Photo-diode

(c) Photo-cell

(d) Solar -cell

(iv) A convex lens of focal length 25 cm is kept at the distance 'd' from a concave lens of focal length 15 cm. Value of d using the given diagram is : [1]



(a) 40 cm

(b) 30 cm

(c) 20 cm

(d) 10 cm

(v) Plane wavefronts are produced by : [1]

(a) a point source of light

(b) a line source of light

(c) a source at infinity

(d) all types of sources of light

(vi) Ratio of de Broglie wavelengths of a proton and an alpha particle moving with same velocity is approximately : [1]

(a) 2 : 1

(b) 4 : 1

(c) 1 : 2

(d) 1 : 4

(vii) In the forward biasing, depletion layer width : [1]

(a) gets increased

(b) gets decreased

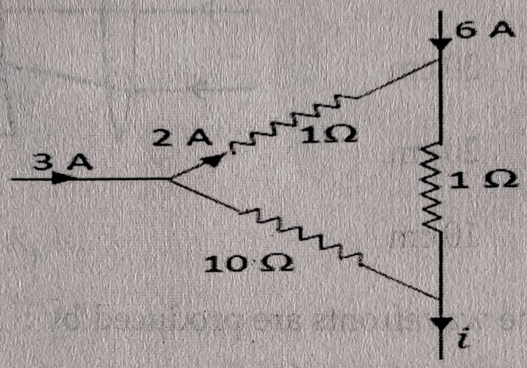
(c) remains the same

(d) becomes very large

(B) Answer the following questions briefly :

(i) What is the expression of electric field intensity at the centre of a dipole having charges +q and –q at a seperation of 2ℓ ? [1]

(ii) What is the value of the current 'i' . [1]



(iii) What is the difference between resistance and reactance ? [1]

(iv) Does diffraction of light give information about the transverse nature of light ? [1]

(v) Define coherent sources of light ? [1]

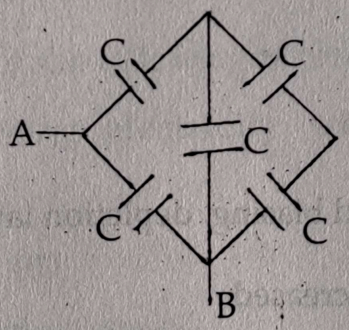
(vi) State the function of a moderator in nuclear reactor. [1]

(vii) What is potential barrier in a junction diode ? [1]

SECTION 'B' [14 MARKS]

Question 2 [2]

(i) Find equivalent capacitance of this combination between A and B.



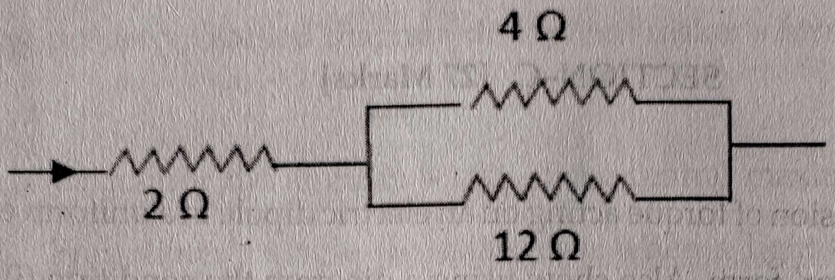
(ii) Two charged particles kept at the seperation'r', have masses m each and charge 'q' each. If these are released from rest then find their velocity at infinite seperation.

Question 3 [2]

Define : (i) charge mobility

(ii) potential gradient

Question 4 [2]



If power in 4Ω resistor is 9W then. Find power in 2Ω resistor.

Question 5 [2]

(i) A 10 m long wire carrying 3 A current, is kept parallel to 6 cm long wire carrying 7 A current at 5 m seperation. Find total force on 10 m long wire.

OR

(ii) A proton is moving in a region having uniform electric field $20\,^{N}/_{C}$ and uniform magnetic field 5 T in a direction perpendicular to the fields. If fields are also mutually perpendicular then find the velocity of the proton under the condition that the proton moves undeviated.

Question 6 [2]

(i) Write any one application of x-rays.

(ii) Write the formula of speed of electromagnetic wave in terms of amplitude of electric and magnetic wave.

Question 7 [2]

Explain any one phenomenon based on total internal reflection using proper diagram.

Question 8 [2]

A galvanometer has a resistance of 15 Ω and it shows full scale deflection for a current of 4 mA. How will you convert the galvanometer into an ammeter of range 0 to 6 A.

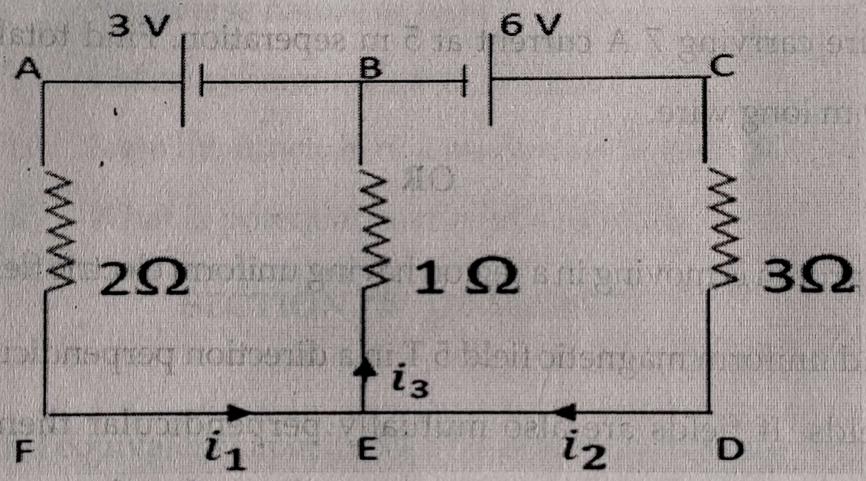
SECTION–C [27 Marks]

Question 9 [3]

Write expression of torque acting on an electric dipole in a uniform electric field in 'vector' form. Also show using a diagram the condition (i) when torque will be maximum and (ii) when torque is minimum.

Question 10 [3]

Find i_1, i_2 and i_3 using the given circuit diagram.



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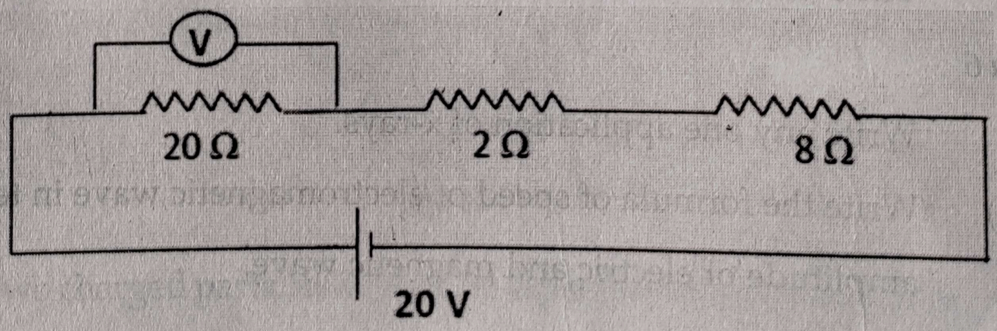


If voltmeter connected in the circuit reads 10V then what will be its reading if it is connected across 2Ω ?

Question 11 [3]

Obtain an expression of magnetic field intensity at the centre of a current carrying coil. Draw a properly labelled diagram also.

Question 12 [3]

Using properly labelled diagram derive lens maker's formula.

OR

(i) Calculator the angular width of the central maxima obtained in Fraunhofer's single slit diffraction when a light of wavelength 550 nm falls normally on a slit of width 1.1×10^{-4} cm

(ii) State any one difference between interference of light and diffraction of light.

Question 13 [3]

Using Huygen's principle prove Snell's law of refraction of light.

Question 14 [3]

In Young's double slit experiment two sources of wavelengths 4000Å and 7000Å are used. Find minimum distance from the centre where their minimas coincide. Screen seperation is 2 m and slit seperation is 1 mm.

Question 15 [3]

With reference to photoelectric effect, draw the graphs to show the variation of photoelectric current :

(i) with frequency keeping intensity as the same.

(ii) with intensity keeping frequency as the same.

(iii) with frequency below threshold frequency or cut off frequency.

Question 16 [3]

(i) Give one example of nuclear fission and nuclear fusion each.

(ii) Explain the function of coolant in a nuclear reactor.

Question 17 [3]

Explain working of p-N junction diode as a half wave rectifier using suitable circuit diagram.

SECTION-D [15 Marks]

Question 18 [5]

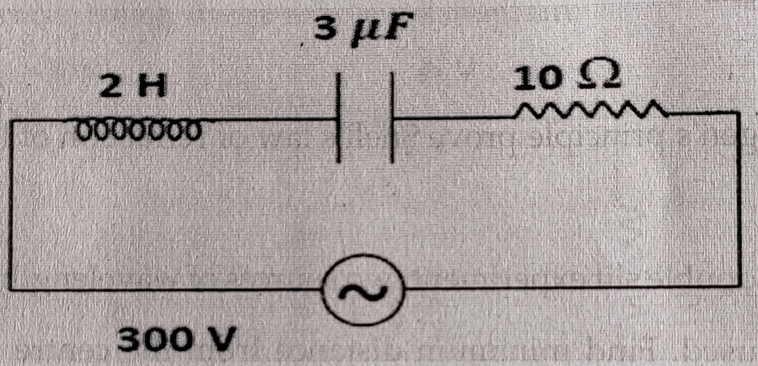
Draw the graph showing variation of impedance against frequency for

(a) LR circuit

(b) LC circuit

(c) CR circuit

(d) Find maximum value of peak value of current in a circuit.



OR

(i) A metallic rod of 2 m is horizontal and is falling with a constant speed 2 m/s in a uniform horizontal field 0.5 T directed towards north. Find induced emf when the rod is in- [3]

(a) North-South direction

(b) East-West direction

(ii) Draw phasor diagram when V=300 sin 100 πt and

$$i = 20\sin\left(100\pi t - \frac{\pi}{4}\right) \text{ at } t = \frac{1}{300} \text{ second.}$$ [2]

Question 19 [5]

(a) Using Bohr's theory of hydrogen atom, obtain an expression of kinetic energy and potential energy of electron in nth Bohr's Orbit.

(b) Write general formula of wavelength for Lyman & Balmer series.

OR

The electron in a given Bohr orbit has a total energy of -1.5ev. Calculate its : [5]

(a) Kinetic energy

(b) potential energy

(c) Wavelength of radiation emitted when this makes a transition to the ground state.
(given : energy in the ground state =-13.6 ev and Rydberg's constant $=1.09\times10^{7}\ m^{-1}$)

(d) When do we get Balmer series in absorption spectrum.

(e) What is limitation of Bohr's Theory.

Question 20 [5]

Read the passage given below and answer the questions that follow :

The flow of charge in a particular direction contributes the current. Current is measured in Ampere. Quantitatively, electric current in a conductor across an area held perpendicular to the direction of flow of charge is defined as the amount of charge flowing across the area per second.

(i) What is thermal velocity?

(ii) Why current is not obtained when potential difference is not applied ?

(iii) What is the vector expression of Ohm's law

(iv) An electron is revolving around the nucleus in an atom. Will it produce a current ? Explain.

(v) What will be the effect of increase in temperature on thermal velocity of free electrons in a metal ?

Useful constants and relations:

1.	Permittivity of vacuum	ϵ_0	:	8.85×10^{-12} F/m
2.	Constant for Coulomb's law	$\frac{1}{4\pi\epsilon_0}$	:	9×10^{9} m/F
3.	Constant in Magnetism	$\frac{\mu_0}{4\pi}$	:	1×10^{-7} H/m
4.	Elementary charge	e	:	1.6×10^{-19} C
5.	Mass of an electron	m	:	9×10^{-31} kg

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