Code No. : 042

PRE BOARD EXAMINATION-2 (JANUARY 2020)

CLASS: XII **PHYSICS** **Time: 3 hrs.**

MAX. MARKS: 70

General Instruction :

1. All questions are compulsory. There are 37 questions in all.
2. This question paper has four sections Section A, Section B, Section C and Section D.
3. Section A contains twenty questions of one mark each, Section B contains seven questions of two marks each. Section C contains seven questions of three marks each and section D contains three questions of five marks each.
4. There is no overall choice. However, internal choices have been provided in two questions of one mark each, two questions of two marks, one question of three marks and three questions of five marks weightage. You have to attempt only one of the choices in such questions.
5. You may use the following values of physical constants wherever necessary.

$c = 3 \times 10^{8}$ m/s

$h = 6.63 \times 10^{-34}$ Js

$e = 1.6 \times 10^{-19}$ C

$\mu_0 = 4\pi \times 10^{-7}$ T m A^{-1}

$\varepsilon_0 = 8.854 \times 10^{-12}$ $C^2 N^{-1} m^{-2}$

$\frac{1}{4\pi\varepsilon_0} = 9 \times 10^{9}$ N $m^2 C^{-2}$

$m_e = 9.1 \times 10^{-31}$ kg

mass of neutron = 1.675×10^{-27} kg

mass of proton = 1.673×10^{-27} kg

Avogadro's number = 6.023×10^{23} per gram mole

Boltzmann constant = 1.38×10^{-23} JK^{-1}

SECTION A

Directions (Q1-Q10) select the most appropriate option from those given below each question

1) Two charges are at a distance d apart in air. Coloumb force between them is F. If a dielectric material of dielectric constant K is placed between them, the Coulomb force now becomes 1
(a) F/K (b) FK (c) F/K^2 (d) K^2F

2) In a cyclotron, a charged particle 1
(a) undergoes acceleration all the time
(b) speeds up between the dees because of magnetic field
(c) speeds up in a dee
(d) slows down within a dee and speeds up between dees

3) A magnetic needle is kept in a non-uniform magnetic field. It experiences 1
(a) a force and a torque
(b) a force but not a torque
(c) a torque but not a force
(d) neither a force nor a torque

4) Whenever the flux linked with a circuit changes, there is an induced emf in the circuit. This emf in the circuit lasts 1
(a) for a very short duration
(b) for a long duration
(c) forever
(d) as long as the magnetic flux in the circuit changes

5) The self inductance L of a solenoid of length *l* and area of cross section *A*, with a fixed number of turns N increases as 1
(a) l and A increase (b) l decreases and A increases
(c) l increases and A decreases (d) both l and A decrease.

6) In an LCR circuit contains L= 8 henry; C= 0.5 μF, R= 100 Ω. Then the resonant frequency will be: 1
(a) 600 rad/s (b) 500 rad/s (c) 600 Hz (d) 500 Hz

7) What is wavelength of signal weather frequency of 300 megahertz? 1
(a) 2m (b) 20m (c) 10m (d) 1m.

8) Which of the following is not due to total internal reflection? 1
(a) Working of optical fibre
(b) Differene between apparent and real depth of a pond
(c) Mirage on hot summer days
(d) Brilliance of diamond

9) If the focal length of the objective lens is increased then magnifying power of 1
(a) Microscope will increase but that of telescope decrease
(b) Microscope and telescope both will increase
(c) Microscope and telescope both will decrease
(d) Microscope will decrease but that of telescope will increase

10) Two waves having the intensities in the ratio of 9:1 produce interference. The ratio of maximum to minimum intensity is 1
(a) 10:8 (b) 9:1 (c) 4:1 (d) 2:1

Directions (Q11 –Q15) Fill in the blanks with appropriate answer.

11) For light diverging from a point source, the wavefront is _________ 1

OR

_________ is due to the superposition of two waves coming from two coherent sources.

12) The velocity of photon in different media is _________ 1

13) An alpha particle is equivalent to ________________. 1

14) One electron volt is the ________________ when accelerated through a potential difference of 1 V. 1

15) The angle of scattering θ for zero value of impact parameter b is _____________. 1

Directions (Q16 –Q20)Answer the following

16) What is the energy possessed by an electron for n= α ? 1

17) Doping in silicon with indium leads to which type of semiconductor? 1

18) What is the value of potential barrier of p-n junction made of silicon semiconductor?? 1

19) What is direction of diffusion current in a junction diode? 1

20) Which device is used as a voltage regulator? 1

OR

Give the ratio of number of holes and number of conduction electrons in an intrinsic semiconductor.

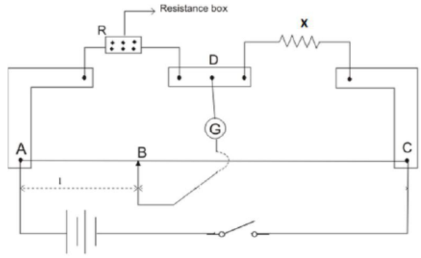
SECTION B

21) Two electric bulbs P and Q have their resistances in the ratio of 1 : 2. They are connected in series across a battery. Find the ratio of the power dissipation in these bulbs. 2

22) Following circuit was set up in a meter bridge experiment to determine the value X of an unknown resistance. 2

(a) Write the formula to be used for finding X from the observations.

(b) If the resistance R is increased, what will happen to balancing length?



23) (a) Define the term magnetic susceptibility and write its relation in terms of relative magnetic permeability. 2

(b) Two magnetic materials A and B have relative magnetic permeabilities of 0.96 and 500. Identify the magnetic materials A and B.

24) Draw the magnetic field lines due to a current passing through a long solenoid. Use Ampere's circuital law, to obtain the expression for the magnetic field due to the current I in a long solenoid having n number of turns per unit length. 2

OR

A rectangular coil of sides *l* 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.

25) (a) Give one use of electromagnetic radiations obtained in nuclear disintegrations. 2

(b) Give one example each to illustrate the situation where there is (i) displacement current but no conduction current and (ii) only conduction current but no displacement current.

26) (a) Monochromatic light of frequency 6.0×10^{14} Hz is produced by a laser. The power emitted is 2.0×10^{-3} W. Estimate the number of photons emitted per second on an average by the source. 2

(b) Draw a plot showing the variation of photoelectric current versus the intensity of incident radiation on a given photosensitive surface.

27) Find the wavelength of the electron orbiting in the first excited state in hydrogen atom. 2

OR

Write two important limitations of Rutherford nuclear model of the atom.

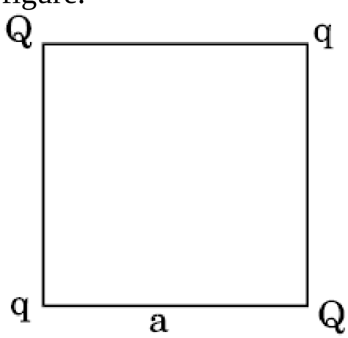
SECTION C

28) (a) Define the term 'conductivity' of a metallic wire. Write its SI unit. 3

(b) Using the concept of free electrons in a conductor, derive the expression for the conductivity of a wire in terms of number density and relaxation time. Hence obtain the relation between current density and the applied electric field E.

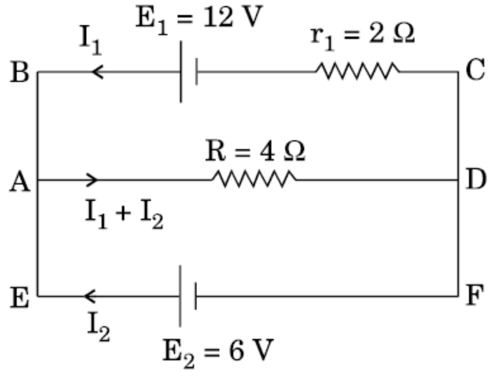
OR

Four point charges Q, q, Q and q are placed at the corners of a square of side 'a' as shown in the figure.



Find the
(a) resultant electric force on a charge Q, and
(b) potential energy of this system.

29) In the electric network shown in the figure, use Kirchhoff's rules to calculate the power consumed by the resistance R = 4Ω. 3



30) Draw a schematic sketch of a moving coil galvanometer and describe briefly its working. 3
"Increasing the current sensitivity of a galvanometer does not necessarily increase the voltage sensitivity'. Justify this statement.

31) (a) Calculate the distance of an object of height h from a concave mirror of radius of curvature 20 cm, so as to obtain a real image of magnification 2. Find the location of image also. 3

(a) Using mirror formula, explain why does a convex mirror always produce a virtual image?.

32) Draw a schematic ray diagram of reflecting telescope showing how rays coming from a distant object are received at the eye-piece. Write its two important advantages over a refracting telescope. 3

33) (a) Draw a plot showing the variation of potential energy of a pair of nucleons as a function of their separation. Mark the regions where the nuclear force is (i) attractive and (ii) repulsive. 3
(b) In the nuclear reaction
$n + {}_{92}U^{235} \longrightarrow {}_{54}Xe^{a} + {}_{b}Sr^{94} + 2n$
determine the values of a and b.

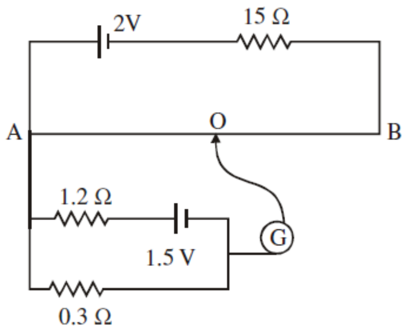
34) (a) Explain with the help of suitable diagram, the two processes which occur during the formations of a p-n junction diode. Hence define the terms (i) depletion region and (ii) potential barrier. 3

SECTION D

35) (a) Use Gauss's law to derive the expression for the electric field (**E**) due to a straight uniformly charged infinite line of charge density λ C/m. 5
(b) Draw a graph to show the variation of E with perpendicular distance r from the line of charge.
(c) Find the work done in bringing a charge q from perpendicular distance r_1 to r_2 ($r_2 > r_1$).

OR

(i) State the principle of working of a potentiometer.
(ii) In the following potentiometer circuit AB is a uniform wire of length 1 m and resistance 10 W. Calculate the potential gradient along the wire and balance length AO (= *l*))
Why alloys like constantan and manganin are used for making standard resistors ?



36) (a) Distinguish between linearly polarised and unpolarised light. 5

(b) Show that the light waves are transverse in nature.

(c) Why does light from a clear blue portion of the sky show a rise and fall of intensity when viewed through a polaroid which is rotated ? Explain by drawing the necessary diagram.

OR

Draw a ray diagram showing the formation of the image by a point object on the principal axis of a spherical convex surface separating two media of refractive indices n_1 and n_2, when a point source is kept in rarer medium of refractive index n_1. Derive the relation between object and image distance in terms of refractive index of the medium and radius of curvature of the surface. Hence obtain the expression for lens-maker's formula in the case of thin convex lens.

37) (a) Draw a labelled diagram of a.c. generator and state its working principle. 5

(b) How is magnetic flux linked with the armature coil changed in a generator ?

(c) Derive the expression for maximum value of the induced emf and state the rule that gives the direction of the induced emf.

(d) Show the variation of the emf generated versus time as the armature is rotated with respect to the direction of the magnetic field.

OR

(a) State the principle of working of a transformer.

(b) Define efficiency of a transformer.

(c) State any two factors that reduce the efficiency of a transformer.

(d) Calculate the current drawn by the primary of a 90% efficient transformer which steps down 220 V to 22 V, if the output resistance is 440 Ω