SAMPLE QUESTION PAPER NO. 6

PHYSICS XII

Time Allowed : 3Hours Maximum Marks: 70

General Instruction

1. There are 33 questions in all. All questions are compulsory.

2. This question paper has five sections: Section A. Section B. Section C, Section D and Section E

3.All the sections are compulsory.

4.SECTION A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of one mark each, SECTION B contains five questions of two marks each, SECTION C contains seven questions of three marks each, SECTION D contains two case study based questions of four marks each and SECTION E contains three long answer questions of five marks each

5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. you have to attempt only one of the choices in such questions.

6. Use of calculators is not allowed.

7. You may use the following values of physical constants where ever necessary

(i) $C = 3x10^{8}$ m/s
(ii) $m_e = 9.1x10^{-31}$kg
(iii) $e = 1.6x10^{-19}$
(iv) $\mu_0 = 4\pi \times 10^{-7}$ TmA^{-1}
(v) $h = 6.63x10^{-34}$Js
(vi) ε_0 **= 8.854187817 × 10^{-12} $C^2/N.m^2$**
(vii) Avogadro's No. = $6.023x10^{23}$ per gram mole

Section A

1. The potential to which a conductor r is raised , depends on

A)The amount of charge
B) Geometry and size of the conductor
C)Both a and b
D)Only on A

2. 8 drops of Hg are combined to form bigger single drop .The capacitance of a single small drop and that of single big drop will

be in the ratio of

A) 1:2
B)1:8
C)8:1
D) None of these

3. Six identical cells, each of emf of six volt are connected are connected in parallel . The net emf across the battery is

A) 6 volt
B) 36 volt
C)24 volt
D) Between 6 volt and 36 volt

4.The sensitivity of moving coil galvanometer can be increased by decreasing

A) Number of turn of the coil
B) magnetic field
C)Area of the coil
D) Restoring couple per unit twist of suspension

5.If a diamagnetic material is placed in a magnetic field , the magnetic field inside the material compare to the out side will be

A) Slightly less
B) Slightly more
C) Very high
D) Same

6. Human body radiates

A) Microwaves
B)X-Ray
C)Infrared waves
D) Gama rays

7.Which of the following does not describe a ray that can be drawn for a concave mirror ?

A) An incident Ray through the mirrors center , reflecting right back through the center

B) An incident ray through the center point , reflecting through the focal point

C) An incident ray trough the focal point , reflecting parallel to the principle axis

D) An incident ray parallel to the principle axis , reflecting through the focal point

8. Which of the following is a dichroic crystal ?

A) Quartz

B) Tourmaline

C) Mica

D) Selenite

9.Moving with the same velocity ,which of the following has the longest de Broglie wavelength ?

A) β Particle
B) α particle
C) proton
D) neutron

10.In Bohr's model of an atom ,which of the following is an integral multiple of h/2 x3.14?

A) Kinetic energy
B) radius of an atom
C) potential energy
D) angular momentum

11. The nuclear forces are

A) charge dependent
B) spin dependent
C) charge dependent
D) long range

12. If germanium is doped with arsenic ,that will results in

A) n type semiconductor
B) p type semiconductor
C) intrinsic semiconductor
D) none of these

In Q.13 to 16.The Assertion (A) and Reason (R) are given .Read the statement carefully and choose the correct alternative from the following

(a) Both A and R are true and R is the correct explanation of A .
(b) Both A and R are true but R is not the correct explanation of A .
(c) A is true but R is false.
(d) Both A and R are false.

13. Assertion. Electron has higher mobility than the hole in a semiconductor.

Reason. Mass of electron is less than mass of hole.

14. Assertion. A photon has no rest mass , yet it carries definite momentum.

Reason. Momentum of photon is due to its energy and hence its equivalent mass.

15. Assertion. Dipole oscillation produce electromagnetic waves.

Reason. Accelerated charge produces electromagnetic waves.

16. Assertion. In a non -uniform electric field ,a dipole will have translatory as well as rotatory motion.

Reason. In a non- uniform electric field , a dipole experiences a force as well as a torque.

Section -B

17. Derive the expression for electric field at a point on the equatorial line of an electric field.

OR

Obtain the expression for the torque experienced by an electric dipole of dipole moment in a uniform electric field E.

18 Define displacement current. What role does it play while charging a capacitor by dc source . Is the value of displacement current same as that of the conduction current?

19. Double -convex lenses are to be manufactured from a glass of refractive index 1.55, with both faces of the same radius of curvature. What is the radius of curvature required if the focal length of the lens is to be 20cm?

20. Ultraviolet light of wavelength 300nm from a 100W mercury source irradiates a photocell made up of a metallic surface. If the stopping potential is 1.5 V, then calculate

(a) Work function of the metals

(b) the number of photoelectrons emitted per second.

21. State Huygens postulates of wave theory . sketch the wave front emerging from a point source of light.

Section -C

22. Under what conditions is the phenomenon of total internal reflection observed? Obtain the relation between the critical angle of incidence and the refractive index of the medium.

23. Distinguish between isotopes, isobars and isotones with suitable examples.

OR

Define atomic mass unit and electron volt. Derive relation between them.

24. Using Bohr's postulates obtain the expression for the total energy of the electron in the stationary states of the hydrogen atom. Hence draw the energy level diagram showing how the line spectra corresponding to Balmer series occur due to transition between energy levels.

25. State Gauss's theorem and express it mathematically. Using it, derive an expression for the electric field intensity at a point near a thin infinite plane sheet.

26. A capacitors is charged with a battery and then its plate separation is increased without disconnecting the battery.

What will be the change in

(a) Charge stored in the capacitor?
(b) Energy stored in the capacitor?
(c) Potential difference across the plates of the capacitor?

27. A galvanometer having 30 divisions has a current sensitivity of 20 μA/division. It has a resistance of 20 Ω. How will you convert it into an ammeter measuring upto1 ampere? How will you convert this ammeter into voltmeter reading upto1 volt?

OR

A solenoid of length 0.5 m has a radius of 1 cm and is made up of 500 turns. It carries a current of 5 A . What is the magnitude of the magnetic field inside the solenoid?

28 Derive an expression for the mutual induction of two long solenoids wound over one another, in terms of their number of turns N_1,N_2 area A and common length l.

SECTION –D

Case Study Based Questions

Read the following paragraph and answer the questions that follow.

29. A Faraday cage or Faraday shield is in an enclosure made of a conducting material. The fields within a conductor cancel out with any external fields, so the electric field within the enclosure is zero. These Faraday cages act as big hollow conductors you can put things in to shield them from electrical fields. Any electrical shocks the cage receives, pass harmlessly around the outside of the cage.

(A) Which of the following material can be used to make a Faraday cage?
(a) plastic
(b) glass
(c) copper
(d) wood

(B) Example of a real – world Faraday cage is

(a) car
(b) plastic box
(c) lightning rod
(d) metal rod

(C) What is the electrical force inside a Faraday cage when it is struck by lightning?

(a) the same as the lightning
(b) half that of the lightning
(c) zero
(d) a quarter of the lightning

(D) An isolated point charge +q is placed inside the Faraday cage.

Its surface must have charge equal to

(a) Zero (b) +q (c) -q (d) +2q

30. Both alternating and direct currents are measured in ampere . however it is not possible to define AC ampere in terms of forces between two parallel wires carrying AC currents as DC ampere is defined . This is because the A.C. changes direction with the source frequency and so that the net force would add up to 0 . To overcome this problem we define a.c. ampere in terms of Joule heating ($H = I^2RT$) which is independent of direction of current . Hence the rms value of alternating current in a circuit is one ampere if the current produces the same average heating effect as 1 ampere of direct current would produce under the same conditions. Alternating currents and voltages are measured by a.c. ammeter and a.c. voltmeter respectively. As the working of these instruments is based on the heating effect of the current , so they are called hot wire instruments .

1. The frequency of an alternating voltage is 50 cycles per second and its amplitude is 120V . Then its rms value will be
(a) 84.8V
(b) 42.4V
(c) 56.5V
(d) 75.5V

2. In the AC circuit the current is expressed as $I= 100\sin200\pi t$. In this circuit the current rises from 0 to peak value in time
(a) 1/300sec
(b)1/400sec
(c) 1/100sec
(d)1/200sec

3. The peak value of an alternating emf E given by $E = E_O \cos wt$ is 10V and its frequency is 50Hz . At a time t=1/600sec , the instantaneous emf is
(a) 1V
(b) 5V
(c) 10V
(d) 8.65V

4. The rms value of ac current which when passed through a resistor produces heat enrgy 4times that produced by d.c. of 2A through the same resistor in same time , is
(a) 32A
(b) 2A
(c) 4A
(d) 8A

SECTION – E

31. (A) State Biot - Savart law and express in the vector form .
(B) Deduce the expression for the magnetic field at a point on the axis of current carrying circular loop of a radius 'R' , distant 'x' from the centre . Hence write the magnetic field at the centre of the loop .

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

32. (A) Explain the formation of depletion layer and potential barrier in p-n junction.
(B) Explain working of full wave rectifier . Draw its input and output waveform

OR

(A) On the basis of energy band diagram, distinguish between
1. Metal 2. Insulator 3. Semi-conductor
(B) Draw the circuit diagrams of a p-n junction diode in
1. Forward Bias 2. Reverse Bias

33. A point object is kept on the principal axis of a convex spherical surface of radius of curvature R , separating a medium of refractive index μ_2 from a medium of refractive index μ_1 (in which the object is kept). A real image of the object is formed by this surface. Draw the ray diagram to show the imag formation an derive the relation between the object distance and image distance in terms of μ_1 , μ_2 an R.

OR

(A). Use Huygen's principle to explain the formation of diffraction pattern due to a single slit illuminated by a monochromatic source of light.

(B). When the width of slit is made double the original width, how this affect the size and intensity of the central diffraction band ?