No. of printed pages:4

INDIAN SCHOOL SOHAR
PREBOARD EXAM- 2017
PHYSICS – THEORY

CLASS: XII **MARKS:70**
DATE: 8 /1/2017 **TIME:3hrs**

General Instructions:

1. All questions are compulsory.
2. There are 26 questions in all .Questions 1 to 5 carry one mark each, questions 6 to 10 carry two marks each, questions 11 to 22 carry three marks each. Question 23 is a value based question carrying four marks and questions 24 to 26 carry five marks each.
3. There is no overall choice. However, internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each.
4. You have to attempt only one of the given choices in such questions.
5. Use of calculator is not permitted.
6. You may use the following physical constants wherever necessary

C= 3X 10^8 m/s ***h= 6.626 X10^{-34} Js*** ***e=1.6X 10^{-19} c***

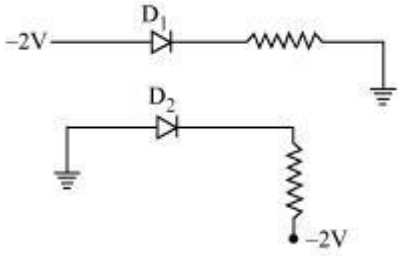
$\frac{1}{4\pi\varepsilon O}$ ***=9 X 10^9 Nm^2/c^2.*** ***μo=4π X 10^{-7} T m A^{-1} .*** ***N_A= 6.023 X10^{23}/mol***

Mass of proton=1.676 X 10^{-27} kg. ***Mass of neutron=1.675 X 10^{-27} kg.***

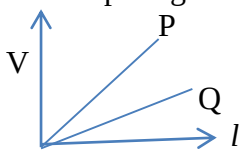
SECTION-A

1.Show graphically how the photoelectric current for a given photo sensitive surface varies with anode potential for the same intensity but different frequencies of incident radiations.

2.Which one of the two diodes D1 and D2 in the given figures is (i) forward biased (ii) reverse biased ?



3. The variation of potential difference V with length *l* in case of two potentiometers P and Q is as shown. Which one of these two will you prefer for comparing the emfs of two primary cells.



4. A mobile is also called a cell. Why?

5. Suggest a possible communication channel for the transmission of a message signal which has a bandwidth of 5 MHz.

SECTION-B

6. A spherical Gaussian surface encloses a charge of 8.85×10^{-10}C.
(i) Calculate the electric flux passing through the surface.
(ii) How would the flux change if the radius of the Gaussian surface is doubled and why?

7. In an ammeter (consisting of a galvanometer and a shunt), 0.5% of the main current passes through the galvanometer. Resistance of the galvanometer coil is G. Calculate the resistance of the shunt in terms of galvanometer resistance, G.

8. Obtain the expression for mutual inductance of a pair of coaxial circular coils of radii 'r' and 'R' (R>r) placed with their centres coinciding.

9. What does the statement, "natural light emitted from the sun is unpolarised" mean in terms of the direction of electric vector? Explain briefly how plane polarized light can be produced by reflection at the interface separating the two media.

10.On what principle does a metre bridge work? Draw a circuit diagram and explain how this device can be used for determination of an unknown resistance.

OR

10.Derive a mathematical expression for resistivity of a conductor in terms of number density of charge ca rriers in the conductor and relaxation time.

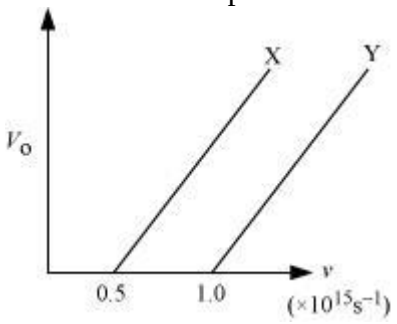
SECTION-C

11.A circular copper disc 10 cm in radius rotates at a speed of 20π rad/s about an axis through its centre and perpendicular to the disc. A uniform magnetic field of 0.2 T acts perpendicular to the disc.
(i) Calculate the potential difference developed between the axis of the disc and the rim.
(ii) What is the induced current if the resistance of the disc is 2 Ω?

OR

11.A resistor of 200 Ω and a capacitor of 40 μF are connected in series to 220 V a.c. source with angular frequency (ω) = 300 Hz. Calculate the voltages (rms) across the resistor and the capacitor. Why is the algebraic sum of these voltages more than the source voltage? How do you resolve this paradox?

12. The following graph shows the variation of stopping potential V_0 with the frequency ν of the incident radiation for two photosensitive metals X and Y:



(i) Which of the metals has larger threshold wavelength? Give reason.
(ii) Explain giving reason, which metal gives out electrons, having larger kinetic energy, for the same wavelength of the incident radiation.
(iii) If the distance between the light source and metal X is halved, how will the kinetic energy of electrons emitted from it change? Give reason

13.Derive the expression for force per unit length between two long straight parallel current carrying conductors. Hence define one ampere.

14.(a)Derive the prism formula with the help of diagram.
(b)A ray of light incident on an equilateral glass prism shows minimum deviation of 30°.
Calculate the speed of light through the glass prism.

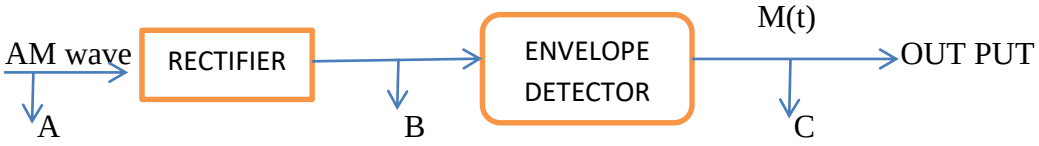
15. Derive the law of radioactive decay. Establish a mathematical relation between half-life period and disintegration constant of a radioactive nucleus.

16. Describe briefly, with the help of labelled diagram, working of a step-up transformer.
A step-up transformer converts a low voltage into high voltage. Does it not violate the principle of conservation of energy? Explain.

17. (a) Using postulates of Bohr's theory of hydrogen atom, show that
(i) the radii of orbits increases as n^2
(ii) the total energy of the electron increses as $1/n^2$, where n is the principal quantum number of the atom.
(b) Calculate the wavelength of Hα line in the Balmer series of hydrogen atom, given $R=1.9047\times10^{7}m^{-1}$

18. (a) Define resistivity of a conductor. Write its S.I. unit.
Two metallic wires of the same material have the same length but cross-sectional area is in the ratio 1:2. They are connected (i) in series and (ii) in parallel. Compare the drift velocities of electrons in the two wires in both the cases (i) and (ii).

19. (a) Explain why high frequency carrier waves are needed for effective transmission of signal.
(b) Draw the wave forms for (i) input AM at A (ii) output B of the rectifier and (iii) output signal C of the envelope detector.



20. State briefly the underlying principle of a transistor oscillator. Draw a circuit diagram showing how the feedback is accomplished by inductive coupling. Explain the oscillator action.

21.(a) Which part of the electromagnetic spectrum has the largest penetrating power.
(b)The oscillating magnetic field in a plane electromagnetic wave is given by
$B_y = \left(8\times10^{-6}\right)\sin\left[2\times10^{11}t + 300\pi x\right]$ T
(i) Calculate the wavelength of the electromagnetic wave.
(ii) Write down the expression for the oscillating electric field.

22. Where on the earth's surface is the value of the vertical component of earth's magnetic field zero? A bar magnet of magnetic moment 1.5 J/T lies aligned with the direction of uniform magnetic field of 0.22T. Calculate the amount of work done to turn the magnet so as to align its magnetic moment (i) normal to the field direction, (ii) opposite to the field direction.

SECTION -D

23. Some friends were playing near a pond. Pond appeared shallow to them. So they decided to have fun by

playing in pond water. Kundan happened to pass through. He noticed the intention of the children. Immediately he approached them and instructed them not to indulge in the adventure. He explained that pond was much deeper than it appeared. This way he avoided a misshappening.
(a) What qualities Kundan displayed?
(b) With the help of ray diagram explain, why water appeared less deeper than what actually it was?

SECTION-E

24. Derive the expression for the energy stored in a parallel plate capacitor of capacitance C with air as medium between its plates having charges Q and − Q. Show that this energy can be expressed in terms of electric field as $\frac{1}{2}\varepsilon_0 E^2 A\, d$ where A is the area of each plate and d is the separation between the plates.
How will the energy stored in a fully charged capacitor change when the separation between the plates is doubled and a dielectric medium of dielectric constant 4 is introduced between the plates?

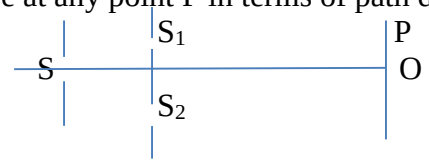
OR

24. Define the term dipole moment $\vec{p}$ of an electric dipole indicating its direction. Write its SI unit.
An electric dipole is placed in a uniform electric field $\vec{E}$. Deduce the expression for the torque acting on it. In a particular situation, it has its dipole moment aligned with the electric field. Is the equilibrium stable or unstable? Justify.

25.(a) Define the term 'wavefront'.Using Huygen's construction of a wavefront, explain the refraction of a plane wavefront at a plane surface and hence verify Snell's law.
(b) A parallel beam of light of wavelength 600 nm is incident normally on a slit of width '*a*'. If the distance between the slits and the screen is 0.8 m and the distance of 2nd order maximum from the centre of the screen is 15 mm, calculate the width of the slit.

OR

25. (a) In the figure given below ,path difference $SS_2 - SS_1 = \lambda / 4$. Obtain the condition for (i) constructive and (ii) destructive interference at any point P in terms of path difference,$\Delta P = S_2P - S_1P$.



(b) State three features by which the phenomenon of interference can be distinguished from that of diffraction.

26. Explain, with the help of a circuit diagram, the use of an n-p-n transistor as an amplifier in common-emitter configuration. Derive the expression for the voltage gain of the transistor.
How will the current gain of a transistor be affected if its base region is made thicker as compared to a usual transistor and why?

OR

26.Draw energy band diagrams for (i) an intrinsic semiconductor, (ii) p-type semiconductor.
Draw symbolic representation of a zener diode and explain its fabrication. Draw its V-I characteristics and explain, with the help of a circuit diagram, its use as a voltage regulator.