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2nd PRE BOARD EXAM 2009—2010
TIME: 3 HOURS SUBJECT -- PHYSICS M.M. 70
CLASS XII
MARKING SCHEME

Q.No	Question/ Answer	Marks
1	Which are of the following will describe the smallest circle when projected with the same velocity v perpendicular to the magnetic field B (i) α particle and (ii) β particle?	
Ans	β particle has smallest value of m/q so β particle will describe the smallest circle (r= mv/ qB).	1
2	In a series LCR circuit the voltage across inductor, a capacitor and a resistor are 30 V, 30 V and 60 V respectively. What is the phase difference between applied voltage and current in the circuit?	
Ans	$\tan\Phi = X_L - X_C/X_R = V_L - V_C/V_R = 0$.	1
3	Name the p-n junction diodes which spontaneous when forward biased .how do we choose the semiconductor to be used in these diodes if the emitted radiation is to be in the visible region?	
Ans	Light emitting diodes (LED).	1
4	Name the part of the electromagnetic spectrum of wave length/10^{-2}m and mention its one application.	
Ans	Microwaves. It is used in RADAR.	1
5	What changes in the focal length of a (1) concave mirror and (ii) convex lens occur, when the incident violet light on them is replaced by red light	
Ans	When violet light is replaced by red light (i) the focal length of concave mirror remains unchanged (ii) the focal length of convex lens increases	 ½ ½
6	Compare the radii of two nuclei with mass number 1 and 27 respectively.	
Ans	$R_1/R_2 = (A_1/A_2)^{1/3} = (1/27)^{1/3} = 1/3$	1
7	What do you mean by peak and root mean square value of alternating current? What is the relation between them?	
Ans	Correct definitions $I = I_0/\sqrt{2}$	½ ½
8	How does the energy gap in a semiconductor vary, when doped with a pentavalent impurity?	
Ans	The energy gap decreases.	1
9	An electric dipole is held in a uniform electric field. (i) Show that no force acts on its (ii) Derive an expression for the torque acting on it.	
Ans	(i) the force on charge +q is $F_1 = q E$ the force on charge –q is $F_1 = q E$ net force $F = F_1 - F_2 = 0$ (ii) correct explain torque $= PE \sin\Phi$	1 1
10	4 identical cells, each of emf 2 v are joined in parallel providing supply of current to external circuit consisting of two 15Ω resistance joined in parallel. The terminal	

	voltage of the cells, as read by an ideal voltmeter is 1.6 volt. Calculate the internal resistance of each cell.	
Ans	1/R = 1/R + 1/R R = 7.5 ohms V = E – Ir I =E/R = 2/7.5 , r' = r/4 =7.5	2
11	For the same angle of incidence the angles of refraction in three media A ,B , C are 15^0 , 25^0, and 35^0 respectively. In which medium the velocity light is minimum.	
Ans	From Snells law n = Sin i/ Sin r = c/v for given I, V ∞ Sin r: r is minimum in medium A so velocity of light is minimum in medium A.	1 1
12	A uniform magnetic field gets modified as shown below when two specimens X and Y are placed in it.(i) Identify the two specimen X and Y. (ii) state the reason for behavior of field lines in X and Y.	
Ans	(1) X is diamagnetic and Y is paramagnetic (ii) magnetic lines in X tend to escape from the substance while magnetic lines in Y tend to go through the substance.	1 1
13	Identify the part of the electromagnetic spectrum to which is (i)Suitable for radar system used in aircraft navigation. (ii)Adjacent to low frequency end of the electromagnetic spectrum. (iii). Produced in nuclear reactions.	
Ans	(i) microwave (ii) radio waves (iii) gamma rays	1 ½ ½
14	A uniform wire of resistance 1 Ω cm^{-1} is bent in the shape of letter A the sides of letter are 30cm each and the cross piece in the middle is 15 cm long while the apex angle is 60^0 find the resistance of letter between the two ends of legs.	
Ans	The letter A is formed of a uniform as shown in fig since the cross piece BD is in the middle of the two legs AC and CE and apex angle is 60^0 there fore AB=BC=CD=DE=BD=15cm since the wire has a resistance of 1 ohms/cm Therefore $R_1=R_2=R_3=rR4=R_5=15\Omega$ the resistance of the letter shown by part BCD here R_2 and R_3 are in series and R_5 in parallel $1/R_p = 1/R_5 + 1/R_{2+}R_3$ Total resistance == $R_1+R_p+R_4 = 40\ \Omega$	2
15	Prove that the instantaneous rate of change of the activity of a radioactive substance is inversely proportional to the square of its half life.	
Ans	Activity of a radioactive substance R == --dN/ dT ==ƕN dR/dT = λ dN/ dT Correct explain.	2
16	The following table gives the value of work function for a new photosensitive metal. S.No Metal Work Function (eV) 1 Na 1.92 2 K 2.15 3 Mo 4.17 In each of these metals is exposed to radiations of wavelength 300 nm which of them will not emit photoelectrons and why?	

Ans	Energy of photon of wave length 300nm = 300 x 10^{-9} m is $E = hc/\lambda$ =4.125 ev is less than work function 4017 ev So Mo will not emit photoelectron .	1 1
17	The ground state energy of hydrogen atom is -13.6 ev. What is the kinetic and potential energies of the electron in this state?	
Ans	Kinetic energy K ==½mv^2 = 1/4$\prod E_0$ $e^2/2r$ Potential energy U = - 1/4$\prod E_0$ e^2/r Total energy E = K +U K =-E and U =2E E=--13.6 ev K= 13.6ev and U =-27.2ev	1 1
OR	A radioactive isotope has a half life of T years. How long will it take the activity to reduce (i)3.125% (ii) 1% of its original value?.	
Ans	$R/R_0 = (1/2)^n = 1/32 = = (1/2)^5$ N=5 t =5T similarly for 1% t=6.64 T	1 1
18	Draw the block diagram of a communication system what are analog and digital signals.	
Ans	Correct diagram Analog signal A signal that varies continuously with time Digital signal A signal that is discrete the presence of signal is denoted and absence 0.	1 ½ ½
19	Two point charges A and B of value +5 *10^{-9} C and +3 *10^{---9}C are kept 6cm apart in air. Calculate the work done when charge B is moved by 1cm towards charge A.	
Ans	Given q_1 =+5 *10^{-9} C q_2 =+3 *10^{---9}C Initial distance r_1 = 6cm = 6*10^{-2} m final distance r_2 =5cm =5*10^{-2}m Initial potential energyU_1 = 1/4π E_0 $q_1 q_2/r_1$ Final potential energy U_2= 1/4π E_0 $q_1 q_2/r_2$ Work done W = $U_2 - U_1$ =4.5*10^{-7}J	3
20	Two point electric charges of values q,2q are kept at a distance d apart in air. A third charge Q is to be kept along the same line in such away that the net force Acting on q and 2q is zero calculate the position of charge Q in terms of q and 2q	
Ans	For equilibrium of charge q net force on q due to charge Q and 2q must be zero 1/4$\prod E_0$ q_Q/x^2+ 1/4$\prod E_0$ q_{2q}/d^2 =0 -----1 For equilibrium of charge 2q net force on 2q due to charge Q and q must be zero 1/4$\prod E_0$ $2q_Q/(d-x)^2$+ 1/4$\prod E_0$ q_{2q}/d^2 =0 ------ 2 Solve 1and 2 we get x=0.41d	 1 1 1
21	Discuss the variation of resistivity with temperature in case of (i) metals (ii) semiconductor (iii) insulators	
Ans	Incase of (i) metals increases with increase of temperature $p=m/n\,e^2 t$ Relaxation time t decrease (ii) increases of temperature number of free electron is increases so resistivity decreases. (iii). increases of temperature number of free electron is increases so resistivity decreases	 1 1 1

OR	State the principle of potentiometer Why do we prefer a potentiometer to measure the of a cell rather than a voltmeter.	
Ans	correct principle A voltmeter draws current from a cell there fore voltmeter measure terminal potential difference rather than emf , while a potentiometer at balance does not draw any current from the cell so the cell remains in open circuit hence potentiometer reads the actual value of emf	3
22	Derive Snell's law of refraction by drawing the reflected wave front corresponding to a plane wave front incident on the boundary separating a rarer medium from a denser medium.	
Ans	Correct derivation S Snells law n = Sin i/ Sinr = c/v	3
23	Define resolving power of a compound microscope. How does the resolving power of a compound microscope change when i) refractive index of medium between the object and objective lens increases. (ii) wavelength of radiation is increased.	
Ans	Definition- The resolving power of a compound microscope. Is defined as its ability to form separate images of two close objects placed near the micro scope resolving power = $2n\sin\emptyset/\lambda$. (i). resolving power increase when) refractive index of medium between the object and objective lens increases (ii). resolving power decrease with wavelength of radiation is increased .	1 1 1
24	A sinusoidal voltage V=200sin 314t is applied to a resistor of 10 ohm resistance. Calculate a. Rms value of voltage b. Rms value of current c. Power dissipated as heat in watt	
Ans	Given V=200sin 314tcomparaing with standard equation $V=V_0 \sin wt$ peak voltage $V_{0=}200$ resistance R=10 Ω a. Rms value of voltage = $V_{0//}/\checkmark 2 = 200/\checkmark 2=141.4V$ b. Rms value of current $=V_{rms}/ R=14.14A$ c. $p=V_{rm*}I_{rm}\cos\emptyset=2KW$(in a purely resistive circuit $\cos\emptyset=1$)	 1 1 1
25	A conducting rod of length l with one end pivoted , is rotated with a uniform angular speed w in a vertical plane , normal to the uniform magnetic field B. Deduce an expression for the emf induced in this rod	
Ans	Correct explain current induced in rod $I =Bwl^2/2$	3
26	Give postulates of bohrs theory Derive expression for radius of n th orbit and energy of electron in nth orbit	
Ans	(i). stationary circular orbit $mv^2/r=1/4\prod E_0 Ze^2/2r$ (ii). the stationary orbit are those in which angular momentum of electron is an integral multiple of $h/2\prod$ (iii). when an electron jumps from one stationary orbit to the other the frequency of emitted or absorbed photon $hv=E_i -E_f$ Radius of nth orbit $r_n= E_0h^2n^2/\prod m e^2$ Energy of electron in nth orbit =-m $Z^2e^4/8 E_0h^2n^2$	1 1 1

27	Define the term modulation explain the need of modulation derive an expression for covering range of TV transmission tower.	
Ans	The process of superposing audible frequency waves on carrier wave is called modulation. The modulation is needed due to i). Transmission of audio frequency ii). The power radiated at audio frequency is quite small hence transmission is quite lossy. iii). Signal Mixture Correct Derivation D=(2hRe)1/2	1 1 1
28	Draw the symbolic representation of (i) pnp (ii) npn transistor. Why is the base region of a transistor thin and lightly doped? With proper circuit diagram show the biasing of pnp transistor in common base configuration. Explain the movement of charge carriers through different parts of the transistor in such a configuration and show that $I_E=I_C+I_B$.	
Ans	Correct symbol Correct reason The function of base region of a transistor is to control the majority charge carriers from emitter to the collector region. Correct circuit diagram. Correct explain	1 1 1 1 1
OR	Draw a labelled circuit diagram of a common emitter amplifier using a p-n-p transistor. Define the term voltage gain and write an expression for it. Explain how the input and output voltages are out of phase by 180^0 for a common-emitter transistor amplifiers.	
Ans	Correct explain with diagram Correct definition voltage gain and correct expression.	3 2
29	State and prove Amperes circuital law. Use Amperes circuital law. To obtain an expression for the magnetic field within a long solenoid	
Ans	The line integral of magnetic filed induction along a closed path is equal to u 0 times the current enclosed by the path. Correct proved Correct derivation for magnetic field with in a long solenoid	1 2 2
OR	State Biot savart law .use it to derive an expression for the magnetic field due to a current carrying circular loop of N turns and radius R, at a point distance x from its centre on the axis of the loop	
Ans	Correct statement Correct derivation	2 3
30	Draw a ray diagram to show the formation of real image of the same size as that of the object placed in front of a converging lens .using this ray diagram establish the relation between u,v, and f for this lens A beaker is filled with water to a height of 12.5 m. The apparent depth of the needle lying at the bottom of the tank as measured by a microscope is 9.4 cm. What is the refractive index of water. If water is replaced by a liquid of refractive index 1.63 up to the same height, by what distance would the microscope be moved to focus on middle again.	

Ans	Correct image Correct relation between u v f (1/f=1/v-1/u) Refractive index =real depth/apparent depth given H =12.5cm h=9.4cm Refractive index of water =12.5/9.4 =1.33 Refractive index of liquid n_l =1.63 Apparent height of h=H/n_l =7.7 cm Displacement of microscope x =9.4-7.7=1.7cm	1 2 2
OR	Describe diffraction of light due to a single slit. Explain formation of pattern of fringes obtained on the screen and plot showing variation of intensity with angle 0 in single slit diffraction A glass prism of refractive angle of 60 and refractive index 1.5 is immersed in a water of refractive index 1.33. Calculate the angle of minimum deviation of the prism in this situation.	
Ans	Correct explain Refractive index of glass with respect to water $_wn_g$ = n_g/ n_w =1.5/1.33 =1.13 Given prism angle A =60^0 From prism formula $_wn_g$ =sin(A+s)/2 /sin A/2 8.6^0	3 2