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PRE-BOARD EXAMINATION 2021-2022

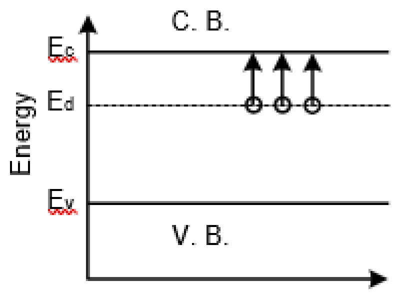
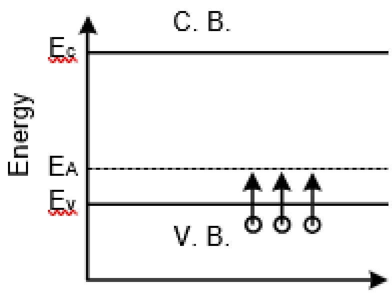
PHYSICS (042)

CLASS - XII

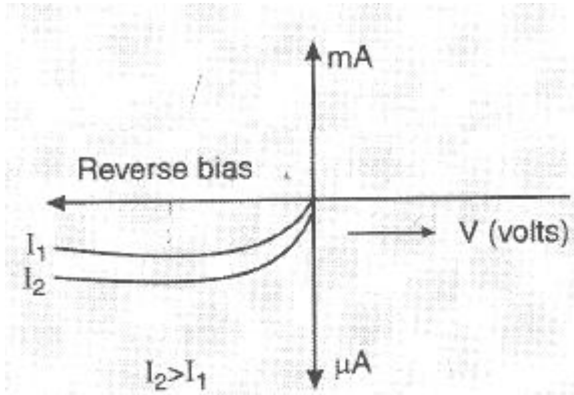
MARKING SCHEME

MM:35 **TIME: 2 Hours**

SECTION A

ANS 1	**(A) N-TYPE:-** **In these the donor energy level is close to the conduction band and far away from valence band.**  **At T >0^0 K** **P- TYPE :-**  **At T >0^0 K** **(B) (i) Reverse bias (ii) forward biased**	**1/2 Mark** **1/2 Mark** **1 MARK**
ANS 2	**(a) (i) When We moved from the heavy nuclei reason to the middle region of the graph there will be an increment in the overall binding energy and hence release of energy .This indicates that energy can be released when a heavy nucleus(A= 240) breaks into two roughly equal parts .This process is called nuclear Fission.** **(ii) when we move from lighter nuclei to heavy nuclei we find that**	**1 /2 MARK**

	there is an increment in the overall binding energy and hence release of energy .This indicates that energy can be released when two or more lighter nuclei fuse together to form a heavy nucleus. This process is called nuclear Fusion. **(B) the given nuclear reaction,** **Mass of reactants = m(.1H2)+m(.1H3)m(.1H2)+m(.1H3)** **=2.0141202+3.016049=2.0141202+3.016049** **=5.030151u=5.030151u** **Mass of products = m(.2H4)+m(.0n1)m(.2H4)+m(.0n1)** **=4.002603+1.008665=4.002603+1.008665** **=5.011268u=5.011268u** **Mass defect, Δm=5.030151u−5.011268uΔm=5.030151u-5.011268u** **=0.018883u=0.018883u** **Energy released =0.018883×931MeV=0.018883×931MeV** **=17.58MeV**	**1/2 Mark** **1 Mark**
	OR	
	(i) From photoelectric equation, we have **$eV_0=hv-\phi_0$ or $V_0=hv/e-\phi 0/e$** **It is an equation of straight line with slope h/e (=constant). It means the slope metals (V_0-v) V_0-v graph** **(=h/e) is same for both metals M1andM2M1andM2.** **(ii) Also, K max=hv−hv$_0$ K max=hv-hv$_0$. For the given frequency of incident light, the smaller is the value of v$_0$, the larger is the value of K max and vice versa. Since material M1 has lower value of threshold frequency v$_0$, so metal M1 will emit photoelectrons of greater K.E.**	**1 MARK** **1 MARK**

ANS 3	**(a) Photo diode is fabricated with a transparent window to allow light to fall on the diode.** **(b) (i) When a reverse biased photo diode is illuminated with the light of energy greater than the forbidden energy gap (Eg), the electron-hole pairs are generated in, or near, the depletion region. Due to junction field, electrons are collected on the n-side and holes on p-side, giving rise to a potential difference.**  	**1/ 2 Mark** **1 MARK** **1/2 MARK**
	SECTION B	
ANS 4	**According Bohr's postulates, in a hydrogen atom, a single electron revolves around a nucleus of charge +e. Then the centripetal force is provided by Coulomb force of gravitational attraction. So,** $mv^2/r = ke^2/r^2$ $mv^2 = ke^2/r$ ----------(1) **m= mass of electron, r= radi, v= velocity of electronus of electron orbit** **Again** $mvr = nh/2\pi$ $V= nh/2\ \pi mr$ **Substituting v in (1) we get,** $M(V= nh/2\ \pi mr)^2 = ke^2/r$ $n^2 h^2\ /4\ \pi^2 mre^2 = r$ --------(2) **using eq. (2) we get** $E_k = k\ e^2\ 4\ \pi^2 me^2\ k\ /\ 2n^2\ h^2$ $E_k = 2\ \pi^2\ k^2\ m\ e^4/n^2\ h^2$ **(ii) potential energy** $E_p = -\ k(e)*(\ e)/r$ $E_p =-\ ke^2\ /r$ $E_p = -k\ e^{2\ *}\ 4\ \pi^2\ k\ m\ e^2/n^2\ h^2$ $E_p =-\ 4\ \pi^2\ k^2\ m\ e^4/n^2\ h^2$ **Total energy of the** n^{th} **orbit** $E= E_p + E_k = -13.6/\ n^2$ **eV** **Or** $E =-\ RCh/n^2$ **where** $R = me^4\ /8\epsilon_0{}^2\ ch^3$ **= Rydberg constant** **For hydrogen atom Z=1**	 **1/2 MARK** **1/2 MARK** **1 MARK**

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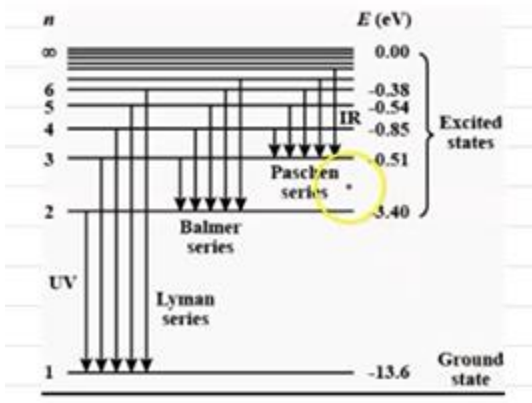
<td>
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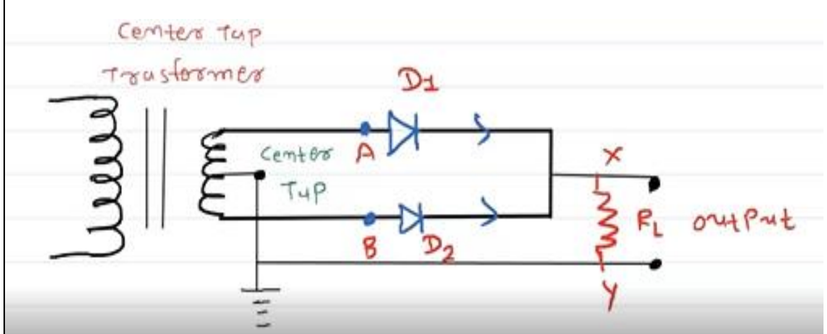
<td>ANS 5</td>
<td>FULL WAVE RECTIFIRE :-


EXPLANATION AND WORKING : We apply an AC voltage to the input transformer. During the positive half-cycle of the AC voltage, terminal 1 will be positive, centre-tap will be at zero potential, and terminal 2 will be negative potential. This will lead to forwarding bias in diode D_1 and cause current to flow through it. During this time, diode D_2 is in reverse bias and will block current through it. During the negative half-cycle of the input AC voltage, terminal 2 will become positive relative to terminal 2 and centre-tap. This will lead to forwarding bias in diode D_2 and cause current to flow through it. During this time, diode D_1 is in reverse bias and will block current through it. As a result, both half-cycles are allowed to pass through. The average output DC voltage here is almost twice the DC output voltage of a half-wave rectifier

INPUT OUT PUT WAVE FORM:-</td>
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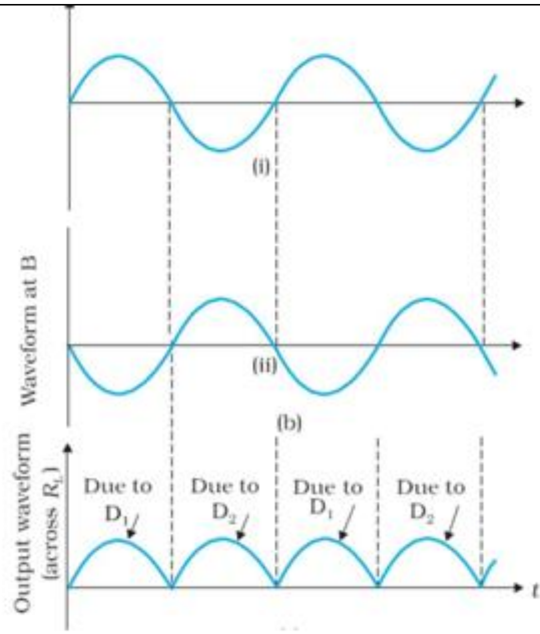
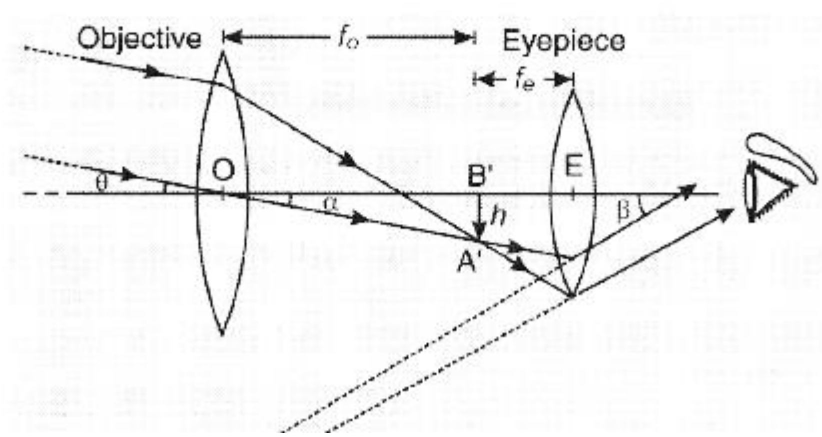
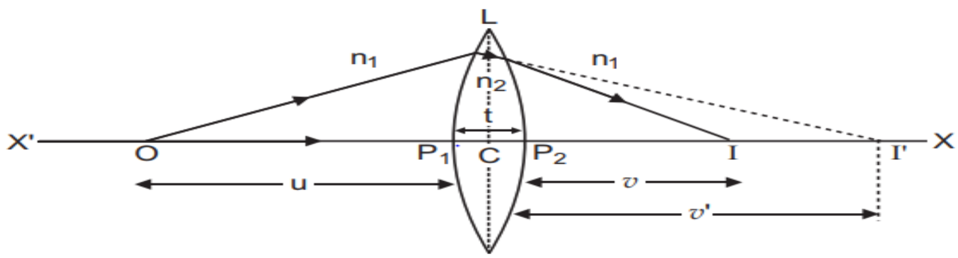
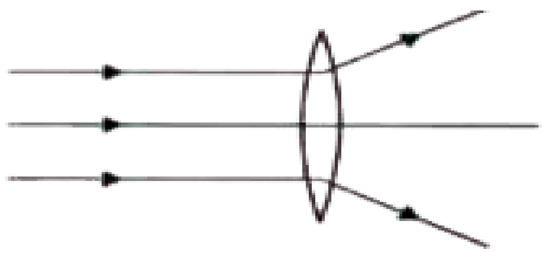
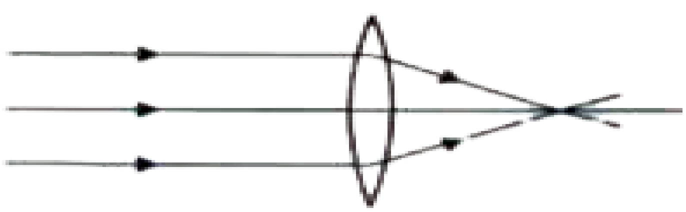
		**1 MARK**
ANS 6	**Energy difference = Energy of emitted photon** **$=E2-E1$** **$=-1.51-(-3.4)=1.89eV=-1.51-(-3.4)=1.89Ev$** **$=1.89\times1.6\times10-19J=1.89\times1.6\times10\text{-}19J$** **$\lambda=hc/E2-E1$** **$=6.6\times10^{-34}\times3\times10^{8}$ / $1.89\times1.6\times10^{-19}$ = $19.8 / (3.024)\times10^{-7}$** **$=6.548\times10-7m=6548Å$** **This wavelength belongs to Balmer series of hydrogen spectrum.**	**3 MARK**
ANS 7	**(1) No effect. This is because the intensity of radiation incident on a photo-sensitive plate is independent on stopping potential.** **(2) The photon of blue light has higher energy as compared to red light; so blue light emits electrons of greater kinetic energy than that of red light.** **(3) Given , for metal A, WA=2eV** **Metal B, WB=4eV** **Since WA<WB** **λ0A>λ0B** **So , threshold wavelength for metal B will be lower.** **(4) K.E of a particle, K = 1/2 m v2 = 1/2m* (mv)2** **K = P2 /m** **P = √ 2mk** **De- Broglie wave length λ =h /p** **For the particle possessing same K.E λ α 1 / √ m** **Me << Mp so proton has smaller de-Broglie wavelength.**	**1/ 2 MARK** **1/2 MARK** **1 MARK** **1 MARK**

ANS 8	**(a) (i) I minimum at 30^0 satisfies the condition,** **d sinθ =λ , d = 1300nm** **(ii) I maxima at 30^0 satisfies the condition,** **d sinθ = 3λ/ 2 d =3* λ/2 sinθ , d = $1950*10^{-9}$ nm** **(b) Angular width = 2λ /a** **Intensity α Area** **(i) intensity increases and angular width decreases** **(ii) No effect on the Angular width ,intensity increases**	**2 MARK** **1 MARK**
ANS 9	**(a)**  **It is the ratio of the angle subtended at the eye, by the final image, to the angle which the object subtends at the lens, m =β /α** **(b) For final image at infinity,** **M∞=f0/fe and L∞=f0+fe** **∴5=f0/fe……..(i)** **and 36=f0+fe36………(ii)** **Solving these two equations, we have** **f0=30cm and fe=6cm** **(c) The aperture is preferred to be large so that the telescope can collect as much as light coming from the distant object as possible**	**1.5 MARK** **1 MARK** **1/2 MARK**
	OR	

	(a)  **Derivation of lens maker formula** **(B)**  **(i) For $\mu_2 > \mu_1$, lens will behave as a diverging lens** **(ii) For $\mu_2 < \mu_1$, lens will behave as converging lens.** 	**2 MARK** **1 /2 MARK** **1/2 MARK**
ANS 11	**(a) R = 20cm . n2 = 1.5 , n1 = 1 and u = -100cm** **Using $n_2/v - n_1/u = (n_2 - n_1)/R$** **1.5/v- 1/-100 = 1.5-1/20……** **On solving v = 100cm** **(b) Power of a lens increases if red light is replaced by violet light P=1/f=(ang−1)(1R1−1R2) and refractive index is maximum for violet light in visible region of spectrum.**	**2 MARK** **1 mark**
ANS 12	**(a) Light waves, originating from two independent monochromatic sources, will not have a constant phase difference. Therefore, these**	**1 MARK**

	sources will not be coherent and, therefore, would not produce a sustained interference pattern. (b) Given λ_1 = 630 nm, β_1 = 7.2 mm, β_2 = 8.1 mm, λ_2 =? We know that $\beta = D\lambda/d$, for the same value of D and d we have $\beta \propto \lambda$, Therefore, we have $\beta_1/\beta_2 = \lambda_1/\lambda_2$, $\lambda_2 = \beta_2 \lambda_1/\beta_1$ On solving λ_2 = 708.75 nm (c) $I_{max} / I_{min} = (a+1/a-1)^2 = (25/9)^2$ On solving a = 4 Therefore $I_1 / I_2 = (a_1 / a_2)^2 = (4/1)^2$ =16:1	1 MARK 1 MARK
	OR	
	(a) In the order of increasing frequency, the waves are Radio wave < Microwave < Infrared < Ultraviolet < γ–rays. (b) (a)) X-rays (b) Microwaves (c) Infrared rays (d) visible light (c) (i) The wavelength is given by $\lambda = c/v = 3*10^8 / 2*10^{10}$ = $1.5*10^{-2}$ m (ii) $B_0 = E_0 / c = 1.6*10^{-7}$ T SECTION C	1 MARK 1 MARK 1 MARK
ANS 12	1. (b) Its critical angle with reference to air is too small. 2. (a) 2.42 (n = sini$_c$) 3. (c) It has high refractive index 4. (d) increase 5. (a) less than the first	5 MARK (1 mark For each)