GOVERMENT OF KARNATAKA

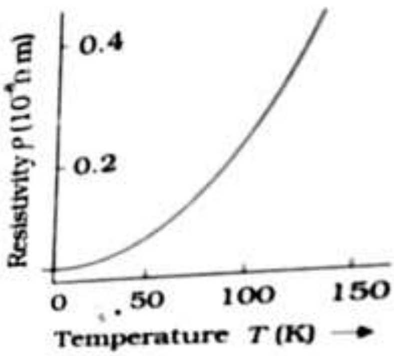
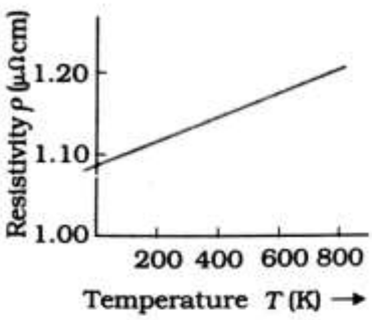
DEPARMENT OF PRE-UNIVERSITY EDUCATION

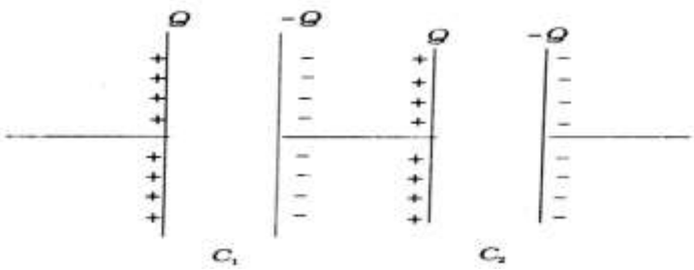
II P U C SUPLIMENTARY EXAMINATION JULY-2018

SCHEME OF VALUATION

PHYSICS (33)

(New Syllabus)

Q.NO	PART -A	
1	Ohm's Law-At constant temperature the current through a conductor is directly proportional to the potential difference between its ends.	1
2	Deflection per unit current is called current Sensitivity.	1
3	$\vec{F} = I(\vec{l} X \vec{B})$ or F=BILsinθ	1
4	Retaining the magnetism even after the removal of the magnetising field is called retentivity.	1
5	At magnetic equator dip is zero.	1
6	The polarity of induced emf is such that it tends to produce a current which opposes the Change in magnetic flux that produced it.	1
7	inductive reactance = capacitive reactance $X_L = X_C$	1
8	In purely inductive or capacitive circuit, no power is dissipated even though a current is flowing in the circuit. This current is called wattles current.	1
9	Frequency remains constant.	1
10	Mass number of the daughter nuclide 234	1
11	 For copper  for nichrome	1+1
12	cyclotron frequency $\vartheta_c = \frac{qB}{2\pi m}$ q-charge B- magnetic field m-mass of the charged particle ϑ_c = cyclotron frequency	1 1

13	The magnetic susceptibility (χ) of a paramagnetic substance is inversely proportional to the absolute temperature (T). $\chi = C\frac{\mu o}{T}$ C-curie constant	1 1
14	Self-inductance of a coil depends on i)number of turns of the coil ii)area of cross section and length (geometry) iii) permeability of the medium (any two)	1+1
15	1.used in LASIK eye surgery 2. UV lamps are used to kill germs in water purifiers 3. Disinfection for virus and bacteria 4.To produce photo electric current in burglar alarm. (any two)	1+1
16	The phenomenon of confining the vibrations of light in a single plane is called polarisation. Reflection / scattering (any one)	1 1
17	$\lambda = \frac{h}{mv}$ $= \frac{6.625 X 10^{-34}}{9.11 X 10^{-31} X2 X 10^{5}} = 3.636 X10^{-9}m$	1 1
18	Advantages of LED 1.Low operational voltage and less power consumption 2.Fast action and no warm up time required 3.Longlife and ruggedness 4.Fast on-off switching capability (any two)	1+1
	PART C	
19	Properties electric field lines 1.Feild lines starts from positive charges and end at negative charges 2.In a charge free region electric field lines can be taken to be continuous curves without any breaks 3.Two field lines can never cross each other 4.Electrostatic field lines do not form any closed loops (any three)	3
20	 Let c_1,c_2 -capacitance of 2 capacitors connected in series Q-charge on each capacitor V_1 V_2-pd across C_1 and C_2 V-Total voltage drop across the combination	

<table>
<tr><td></td><td>Then $V=V_1+V_2$ ---------------(1)
Also Q=CV
$V_1=\frac{Q}{C_1}$ $V_2=\frac{Q}{C_2}$
If system of capacitors is replaced by a single capacitor of equivalent capacitance c_s then $V=\frac{Q}{C_s}$
$(1)\rightarrow\frac{Q}{C_s}=\frac{Q}{C_1}+\frac{Q}{C_2}$ $\frac{1}{C_s}=\frac{1}{C_1}+\frac{1}{C_2}$</td><td>1
1

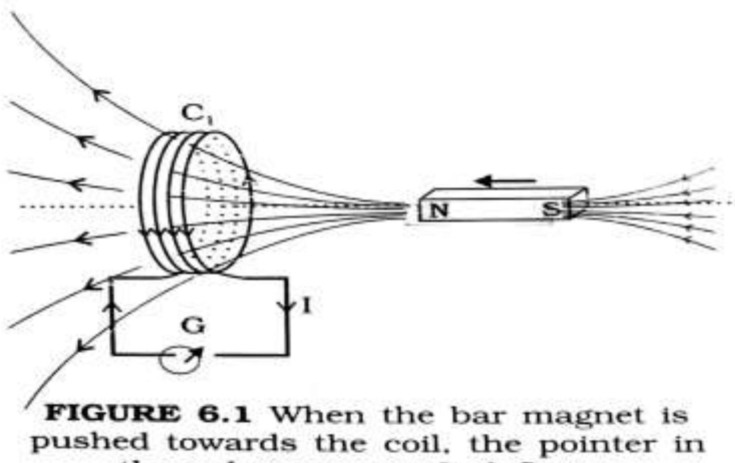
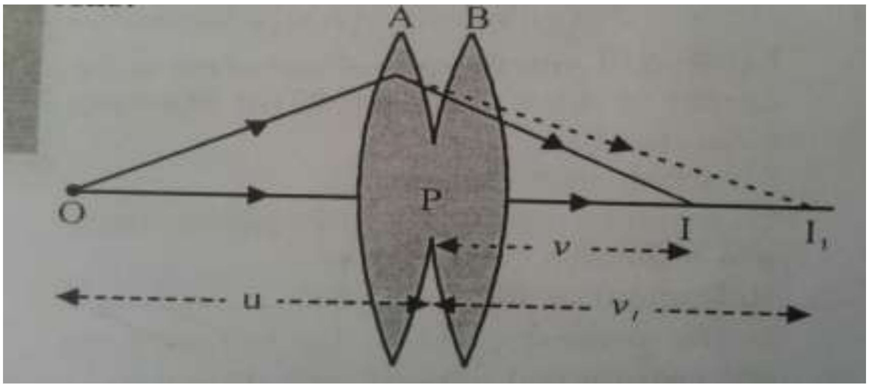
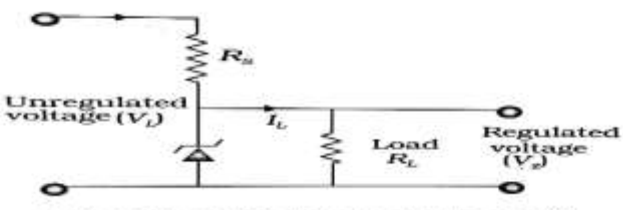
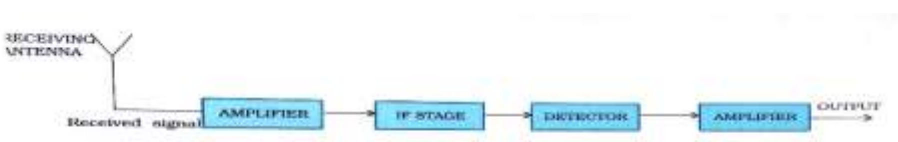
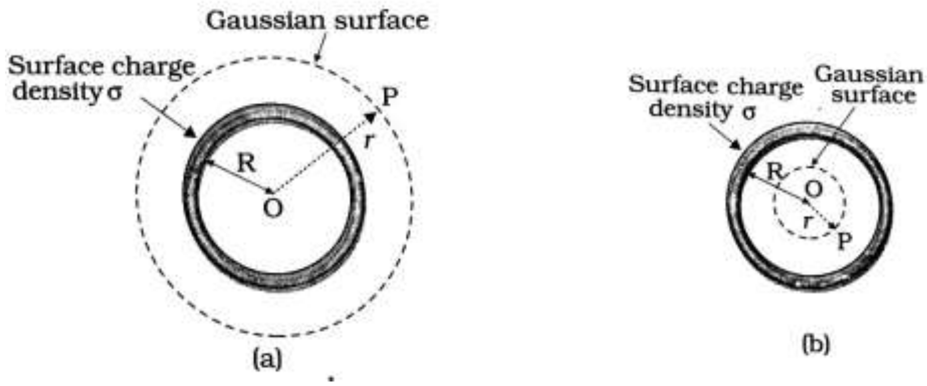
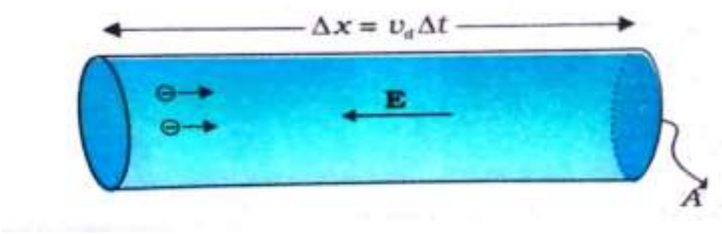
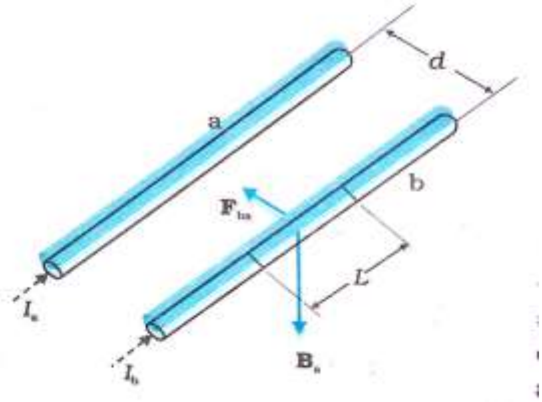
1</td></tr>
<tr><td>21</td><td>Difference between diamagnetic and paramagnetic materials
<table>
<tr><th>Diamagnets</th><th>Paramagnets</th></tr>
<tr><td>1. Weakly magnetised in a direction opposite to the applied magnetic field
2.Move from stronger to weaker part of the external magnetic field.
3. Magnetic susceptibility is Low and negative
4. Example: Bismuth, copper, lead, silicon</td><td>1.Weakly magnetised along the direction of the applied magnetic field.
2. Move from weaker to the stronger part of the external magnetic field.
3. Magnetic susceptibility is low and positive.
4. Example: Aluminium, sodium, calcium, oxygen</td></tr>
</table></td><td>3</td></tr>
<tr><td>22</td><td>Coil and bar magnet experiment


FIGURE 6.1 When the bar magnet is pushed towards the coil, the pointer in the galvanometer G deflects.
In the figure coil C_1 is connected to a galvanometer G
*when N-pole of the bar magnet is pushed towards the coil, there is a momentary deflection in the galvanometer.
*when the magnet is pulled away from the coil galvanometer shows momentary deflection in the opposite direction.
*Faster movements result in a larger deflection.
*But no deflection when the coil and magnet are stationary with respect to each</td><td>1

1</td></tr>
</table>

	other. Or no deflection when there is no relative motion. Therefore it shows that the relative motion between the magnet and coil induces electric current.	1
23	 Let f_1= focal length of first lens, and f_2 = focal length of second lens OP= u= object distance PI= v= image distance due to the combination PI_1= v_1= image distance due to first lens For the image formed by lens A, $\frac{1}{v_1}-\frac{1}{u}=\frac{1}{f_1}$ ----------------(1) For the image formed by lens B, we get $\frac{1}{v}-\frac{1}{v_1}=\frac{1}{f_2}$ ------------------(2) Adding (1) and (2) $\frac{1}{v}-\frac{1}{u}=\frac{1}{f_1}+\frac{1}{f_2}$ But, $\frac{1}{v}-\frac{1}{u}=\frac{1}{f}$ where f= focal length of the combination Therefore $\frac{1}{f}=\frac{1}{f_1}+\frac{1}{f_2}$	1 1 1
24	**1**.The photoelectric emission is an instantaneous process, even when incident radiation is exceedingly dim. **2**. Above threshold frequency, the photocurrent is directly proportional to the intensity of incident radiation. **3**. Above the threshold frequency, saturation current is proportional to the intensity of the incident radiation and stopping potential is independent of intensity. **4.** There exists a certain minimum cut-off frequency called 'threshold frequency' below which no photo emission however intense the incident beam. **5**.Above threshold frequency the kinetic energy of the photo electrons is directly proportional to the frequency of incident radiation and is independent of intensity. (any three)	3
25	Zener diode as a voltage regulator  **FIGURE 14.22** Zener diode as DC voltage regulator	1

	The circuit connections are made as shown in the figure. The Zener diode is reverse biased. If the unregulated input voltage increases, the current through R_s and Zener diode also increases. This increases the voltage drop across R_s without any change in the voltage across the Zener diode. This is because in the breakdown region Zener voltage remains constant even though the current through Zener diode changes. Similarly, if the input voltage decreases, the current through R_s and Zener also decreases. So, any increase or decrease of input results in increase or decrease of voltage drop across R_s without change in voltage across Zener diode. Hence it acts as a voltage regulator.	2
26	A receiver extracts the desired message signals from the received signals at the channel output.  FIGURE 15.12 Block diagram of a receiver.	1 2
27	 Let σ be the uniform surface charge density of a thin spherical shell of radius R **Field outside the shell** Consider a point P outside the shell at a distance r from the centre of the shell. Imagine a gaussian sphere of radius 'r' The electric flux at P due to surface ΔS is $\Delta\varphi = \vec{E}.\overrightarrow{\Delta S} = E\Delta S\ cos\theta = E\Delta S$ {cosθ=1} Total electric flux due to the sphere is $\varphi = E\ 4\pi r^2$ ----------(1) From Gauss law the electric flux $\varphi = \frac{1}{\varepsilon_0}\ total\ charge = \frac{1}{\varepsilon_0} q$ -----------(2) where q= total charge enclosed by the surface From (1) & (2) $E\ 4\pi r^2 = \frac{1}{\varepsilon_0} q$ $\vec{E} = \frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}\ \hat{r}$ b) electric field inside shell E=0	1 1 1 1 1

28	 Consider conductor of length Δx, area of cross section A. v_d-drift speed of free electrons. in a time Δt, let all the electrons travel a distance Δx = v_d Δt. If n= number of electrons per unit volume, then the total charge transported along E across the area A, in a time Δt is ΔQ=neAv_d.Δt. Electric current I=ΔQ/Δt = neAv_d The acceleration acquired by the free electrons is given by $a = \frac{-eE}{m}$ where m= mass of the electron If τ = relaxation time then velocity $v_d = \frac{-eE}{m}\tau$ $I = nAev_d = nAe\frac{-eE}{m}\tau = \frac{ne^2A\tau\, E}{m}$ Current density $J = \frac{I}{A}, J = \sigma E$ therefore $\sigma = \frac{ne^2\tau}{m}$	1 1 1 1 1
29	 Consider two infinitely long straight conductors a & b carrying currents I_a & I_b respectively are separated by a distance ‘d’. The conductor ‘a’ produces the same magnetic field B_a at all points along the conductor ‘b’. $B_a = \frac{\mu_0 I_a}{2\pi d}$ ---------------------(1)	1 1

The conductor ‘b’ experiences a force F_{ba}

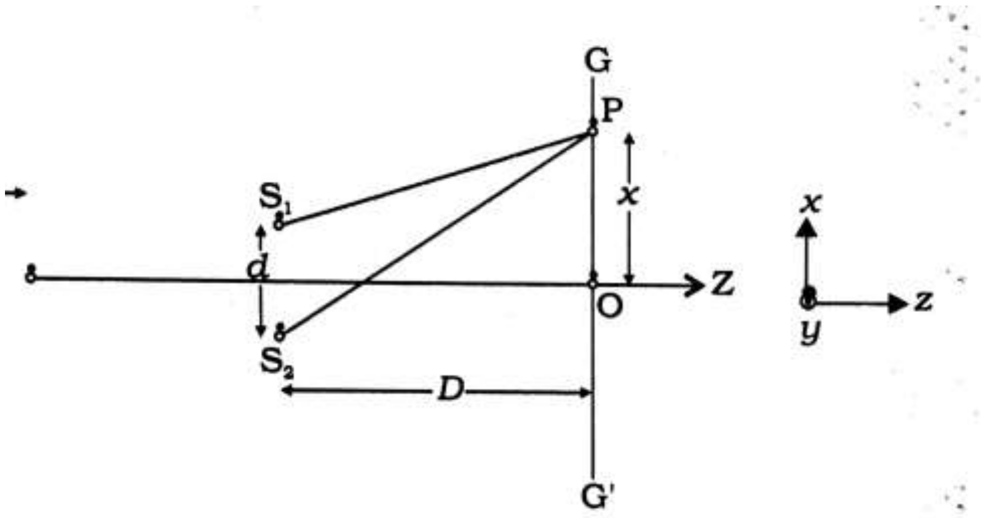
$$F_{ba} = B_a L I_b = \frac{\mu_0 I_a I_b L}{2\pi d}$$ where L= length of the conductor

$$\frac{F_{ba}}{L} = \frac{\mu_0 I_a I_b}{2\pi d}$$ 1

Similarly one can show that F_{ba} = -F_{ab}

(A) ampere- The currents flowing through two infinitely long parallel conductors separated by 1m distance is 1 ampere if they experience a force of 2 X 10^{-7} N per unit length in air or vacuum 2

30



1

S_1 & S_2 are two coherent sources. GG^{I} -screen at a distance D from the sources. Let d=distance between the slits (two sources). P=a point at a distance from the middle of the screen where a bright fringe is formed.

For constructive interference path difference = nλ 1

S_2P-S_1P=nλ where n=0,1,2,3--------------

From the diagram $(S_2P)^2 - (S_1P)^2 = \left[D^2 + \left(x + \frac{d}{2}\right)^2\right] - \left[D^2 + \left(x - \frac{d}{2}\right)^2\right]$

$$(S_2P)^2 - (S_1P)^2 = 2xd$$

$$(S_2P - S_1P)(S_2P + S_1P) = 2xd$$

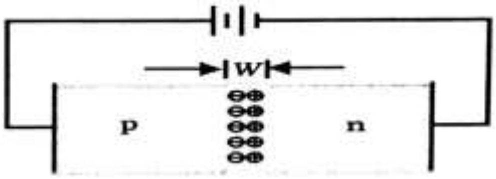
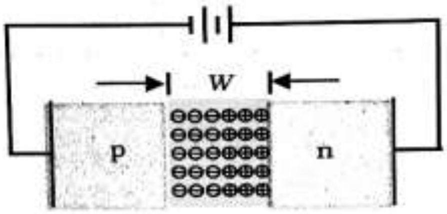
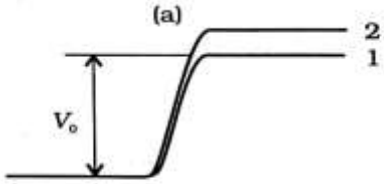
$$S_2P \cong S_1P \cong OP = D$$

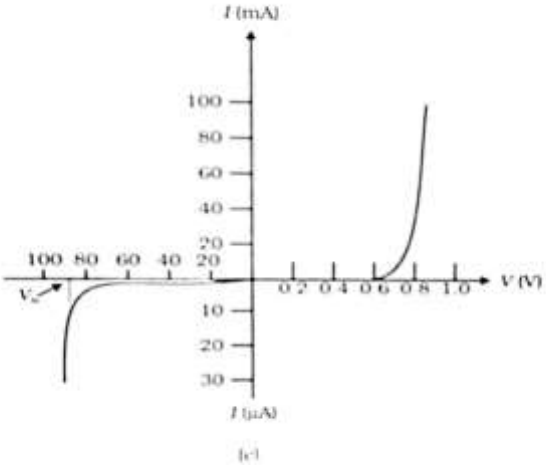
$$S_2P - S_1P = \frac{xd}{D} = n\lambda$$ 1

$$x_n = \frac{n\lambda D}{d} \quad where\ n = 0, \pm1, \pm2, \pm3 \quad for\ bright\ fringes$$

$$x_n = \left(n + \frac{1}{2}\right)\frac{\lambda D}{d} \quad where\ n = 0, \pm1, \pm2, \pm3 \quad for\ dark\ fringes$$

Since the fringes are equally spaced the distance between two consecutive bright or consecutive dark fringes gives fringe width. 1

	$$\beta = x_{n+1} - x_n = \frac{(n+1)\lambda D}{d} - \frac{n\lambda D}{d} = \frac{\lambda D}{d}$$ $$\beta = \frac{\lambda D}{d}$$	1
31	**PN Junction diode under forward bias**  (a)  (b) When the diode is forward biased as shown in the figure the depletion region width decreases and the barrier height is reduced. The electrons from n-side cross the depletion region and reach p-side also holes from p-side cross the junction and reach the n-side. A concentration gradient is developed at the junction boundary. Due to this the motion of charged carriers on either side gives rise to current. The total diode forward current is sum of hole diffusion current and conventional current due to electron diffusion. **PN Junction diode under reverse bias**  (a)  (b) When the diode is reverse biased the depletion region width increases and the barrier height is increased. This supresses the flow of electrons from n-side to p-side and holes from p-side to n-side. Thus, diffusion current decreases. The conventional current is due to drift of the minority charge carriers which is of the order of micro amperes. The current under reverse bias is voltage independent up to a critical reverse bias voltage known as breakdown voltage.	1 1 1 1

	The I-V characteristics are as shown. VI CHARACTERISTICS 	1
32	The radius of the electron orbit is given by $r = \frac{\varepsilon_0 n^2 h^2}{\pi m e^2}$ Total energy E of the electron in a hydrogen atom is the sum of kinetic energy K and potential energy U E=K+U The electrostatic force of attraction between the revolving electrons and the nucleus is balanced by centripetal force in a dynamically stable orbit of hydrogen atom. $F_e = F_c$ $\frac{1}{4\pi\varepsilon_0}\frac{e^2}{r^2} = \frac{mv^2}{r}$ Kinetic energy $K = \frac{1}{2}mv^2 = \frac{e^2}{8\pi\varepsilon_0 r}$ Potential energy $U = -\frac{e^2}{4\pi\varepsilon_0 r}$ (negative sign signifies that the electrostatic force is in the -r direction) The total energy of the electron in a hydrogen atom is $E = K + U = \frac{e^2}{8\pi\varepsilon_0 r} - \frac{e^2}{4\pi\varepsilon_0 r} = -\frac{e^2}{8\pi\varepsilon_0 r}$ Substituting $r = \frac{\varepsilon_0 n^2 h^2}{\pi m e^2}$ $E = -\frac{me^4}{8n^2h^2\varepsilon_0^2}$	1 2 1 1
33	Given A= 100 cm^2=100 X 10^{-4} m^2, d=3 mm = 3 X 10^{-3} m, V= 400 V, U_1 = ? K=2.5, U_2 = ? also U_2~U_1 = ? $U = \frac{1}{2}CV^2$	1

	$$C = \frac{\varepsilon_0 A}{d}$$ Calculating $U_1 = 23.608 \times 10^{-7}$ J $U_2 = 59.02 \times 10^{-7}$ J $U_2 \sim U_1 = 35.412 \times 10^{-7}$ J	1 1 1 1
34	$R_s = R_1 + R_2$ $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2}$ Calculating the value of effective resistance R= 2.76Ω $$I = \frac{E}{R + r} = 1\ A$$ Current through 9 Ω = 0.308 A	1 1 1 1 1
35	$$Z = \sqrt{R^2 + (X_c - X_L)^2}$$ $$X_L = \omega L = 2\pi\vartheta L = 471\ \Omega$$ $$X_c = \frac{1}{\omega c} = \frac{1}{2\pi\vartheta c} = 90.99\Omega$$ Calculation of Z= 380.53 Ω $$I = \frac{V}{Z} = 0.578\ A$$	1 1 1 1 1
36	R_1= 0.2 m, R_2= -0.22 m, n_g=1.5, f_{air} = ? f_{water} = ? $f_{air} \sim f_{water}$ = ? n_w=1.33 $$\frac{1}{f} = (n_{21} - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$ Substituting the values and calculating f = 0.209 m calculating focal length when immersed in water f_{water} = 0.819 m change in focal length = 0.61m	 1 1 1 1 1
37	$T_{1/2}$ = 28 years = 28 X 365 X 24 X 3600 = 8.83 X 10^8 seconds 90 g Sr_{38}^{90} contains 6.023 X 10^{23} atoms $N = \frac{6.023\ X 10^{23}\ X\ 15\ X\ 10^{-3}}{90} = 1.004\ X\ 10^{20}$ atoms	 1 1

	$\lambda = \frac{0.693}{T_{1/2}}$ Decay constant $\lambda = 7.85 \times 10^{-10}$ Rate of disintegration $R = \lambda N$ $R = 7.88 \times 10^{10}$ Bq	1 1 1