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FROM

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Sure Shot Questions and Answers Physics (CBSE Term 2)

Dr. Mukesh Shrimali

Q1 In YDS the intensity at a point on the screen where path difference is λ is K. What will be intensity where path difference is λ/3?

Solution:- Put phase difference φ=2л/3 for path difference λ/3 so from intensity formula

$I = 4I_0 \cos^2\varphi/2 = K \cos^2\varphi/2 = K/4$

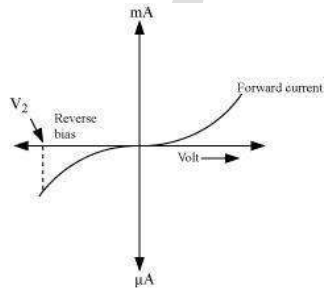
Q2 Two metals A and B have work functions 2 eV and 5 eV respectively. Which metal has lower threshold wavelength?

Solution:

$$W = h\nu_0 = \frac{hc}{\lambda_0} \quad \text{i.e} \quad \lambda_0 \alpha \frac{1}{W}$$

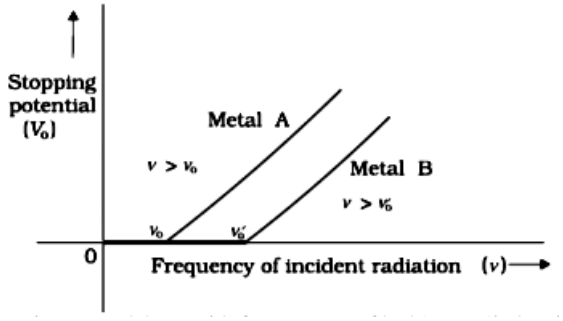
Therefore, metal B with higher work function has lower threshold wavelength.

Q3 Draw the voltage-current characteristic of a PN junction diode.(they may ask for photodiode, solar cell also) Solution:- V-I characteristic for a PN junction diode is given below:



Q4 Which of the two metals in given diagram has higher threshold frequency and which one has higher threshold wavelength

Solution: Metal B has higher threshold frequency and work function and metal A has higher threshold wavelength



Q5 Calculate the shortest and the longest wavelength of Lyman series.

(Take $R_h=10^7\ m^{-1}$) 1/ λ =R(1/1 -1/œ) =R λ=1/R is shortest and similarly λ=4/3R is longest

Q6 (a) In a single slit diffraction pattern,the width of the slit is made double the original width. How does this affect the size and intensity of central bright maxima?

Solution:- As width of central maxima is β =2λD/d hence if d will be double width will reduce to half. But as intensity is square of slit width hence it will become 4 times

(b) Why coherent sources are required to create interference of light?

Solution:- if sources are not coherent, the intensity at a point will go on changing with time. Hence for sustain interference pattern we must have coherent sources.

© A single slit of width a produces first minimum at angle λ/a. At the same angle of λ/a, we get maxima for two narrow slits separated by a. Why

Solution:- for single slit we have superposition of two halves of single slit so path difference will be λ/2 and we get minimum. For double slit waves from two slits have path difference of λ hence maxima will occur..

Q7 What is shape of wave front ,(1) if light emerging out of a convex lens when a point source is placed at its focus(2) Light diverging from point source

Solution: (1)We will get plane wave front (2) Spherical

Q8 How does the fringe width changes when whole apparatus is kept in water of refractive index 4/3?

Solution: β' =β/μ =3/4β hence fringe width will decreases

Q9 (i)Write any two features of photoelectric effect which can not be explained by wave theory

Solution:

(a) The process of photoelectric effect is instantaneous in nature
(b) There exist a threshold frequency for each photosensitive material
(c) Maximum Kinetic energy of emitted electrons in independent of the intensity of incident light

(ii)Electrons are emitted by one of the light through photosensitive surface when it is illuminated by (i) red light (ii) blue light. Identify with which light they emitted

Solution:

(i) Electrons are not emitted with red light.

(ii) Electrons are emitted with blue light.

As frequency of blue light is more than red

Q10 The amplitude of the magnetic field of a harmonic electromagnetic wave in vacuum is B_0 =510nT. What is the amplitude of the electric field part of the wave

Solution: $E_0/B_0 = c$ hence $E_0 = cB_0$ = 153N/C

Q11 Do electromagnetic wave carry energy and momentum.

Solution:- Yes EM waves carry both energy and momentum .As electromagnetic wave contain both electric and magnetic field so $E = hc/\lambda$ and momentum $p = U/c = mc$.

Q12 Work function of aluminium is 4.2eV? If two photons each of energy 2.5eV are incident on its surface, will the emission of electron take place?

A single photon interact with a single electron as individual photon has less energy than threshold so emission will not take place.

Q13 The ground state energy of hydrogen atom is -13.6 eV. What will be Kinetic and potential energy?

Solution:

KE=-TE =13.6eV

PE =2TE = -27.2eV**.**

Q14 A charged particle oscillates about mean position with frequency 10^9Hz. What is frequency of EMW = 10^9Hz

Q15 About 5% of the power of 100W light bulb is converted to visible radiation; What is average intensity when source is at 1m?

Solution P=5% 0f 100=5W

$I=P/4\pi r^2 = 0.4W$

Q16 How are(i) infrared waves (ii) X-rays produced?

Infrared waves produced by hot bodies and molecules as well as atomic transition where as X rays are produced when high energetic electron beam is made incident on a metallic target of high melting point and high atomic weight

Q17. In a half wave rectifier, what is the frequency of ripple if input frequency is 50 Hz, What will be frequency for full wave

For half wave frequency remain same =50Hz

For full wave frequency will become double =100Hz

Q18 Why is photoelectric emission not possible at all frequencies?

Solution:- Every photosensitive surface has a definite work function and hence a definite frequency called threshold frequency. Frequency of light less than it will not be able to start photoelectric emission.

Q19 Why do stable nuclie never have more protons than neutrons

Solution:Protons are positively charged particles and repel one another electrically. This repulsion becomes so great in nuclie with more than 10 protons or so, that an excess of neutrons which produce only attractive forces ,is required for stability

Q20 Name the electromagnetic waves suitable for Radar(Micro) Treat Muscular Strain(Infrared) Kill germs in water purifier(UV) to detect leakage of oil(X rays) improve invisibilty(Infrared)

Q21 Suppose we think of fission of a Fe-56 nucleus in to equal fragments Al-28. Is the fission enegetically possible?Given Mass of Fe-55.93494u, Mass of Al-27.98191u

Q= Mass of Fe-Mass of 2 Al = -0.02888x 931MeV = -26.90Mev

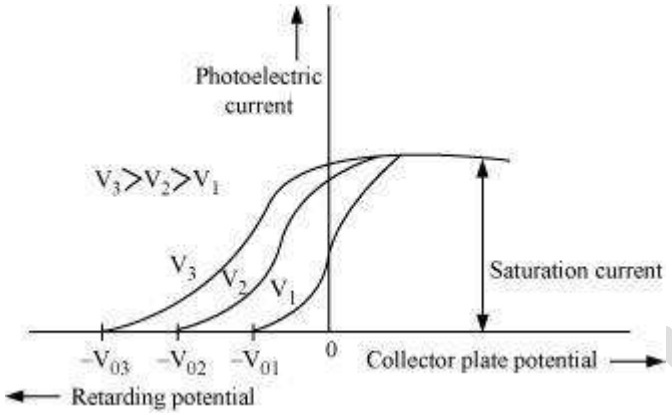
Energy has to be supplied externally so fission is not possible energetically

Q22 How does focal length of a lens change when red light incident on it replaced by violet light?

Decrease in refractive index will increase in focal length as refractive index of violet in more than red so focal length will be less

Q23 Show graphically how the stopping potential for a given photosensitive surface varies with the frequency of incident radiations.

Solution:

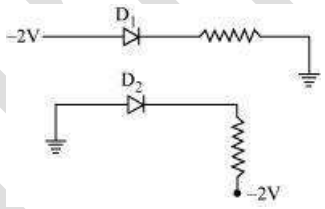


Q24 How is photodiode fabricated?

A photodiode is fabricated using photosensitive semiconducting material with a transparent window to allow light to fall on the junction of the diode. When light energy greater than band gap illuminates, electron hole pairs are generated and free electrons are collected towards n region and holes on p side. Due to this generated emf electric current will flow

Q25 Which one of the two diodes D1 and D2 in the given figures is (i) forward biased,

(ii) reverse biased ?



Solution: If potential of P side is greater than N side we have forward bias otherwise reverse bias

(i) In the given figure, D_2 is forward biased.

(ii) In the given figure, D_1 is reverse biased.

Q26 (a) A small telescope has an objective lens of focal length 150 cm and eye piece is of 5 cm. What is magnifying power and separation between lens in normal adjustment

Solution : $m=F_0/F_e = 150/5 =30$ $L =F_0 + F_e = 155cm$

.(b) State condition for which a large magnification can be achieved in an astronomical telescope

$F_0 > F_e$

Q27 A difference of 2.3eV separates two energy levels in an atom. What is the frequency of radiation emitted when the atom makes transition from the upper level to the lower level

Frequency= E/h =2.3/h =5.55X 10^{14} Hz

Q28 Name the part of the electromagnetic spectrum of wavelength 10^{-2} m and mention its one application.

Solution:- The part of the electromagnetic spectrum which ranges from 0.1 m to 10^{-3} m is known as microwave. Microwaves are used in radar systems for aircraft navigation.

Q29 An electron and alpha particle have the same de−Broglie wavelength associated with them. How are their kinetic energies related to each other?

Solution:- Kinetic energy of a particle of mass *m* and velocity *v* is given as:

$$K = \frac{1}{2}mv^2 = \frac{1}{2}m\frac{p^2}{m^2} = \frac{p^2}{2m} \qquad [\because p = mv]$$

$$p^2 = 2mK$$

$$p = \sqrt{2mK} \qquad (1)$$

de-Broglie wavelength associated with a particle of momentum *p* is given as:

$$\lambda = \frac{h}{p} = \frac{h}{\sqrt{2mK}} \qquad (2)$$

It is given that an electron and an alpha particle have the same de-Broglie wavelength. Hence, we can write:

$$\lambda_e = \lambda_\alpha$$

$$\frac{h}{\sqrt{2m_eK_e}} = \frac{h}{\sqrt{2m_\alpha K_\alpha}}$$

$$m_eK_e = m_\alpha K_\alpha$$

$$\frac{K_e}{K_\alpha} = \frac{m_\alpha}{m_e}$$

$$\because m_\alpha > m_e$$

$$\therefore \frac{K_e}{K_\alpha} = \frac{m_\alpha}{m_e} > 1$$

$$K_e > K_\alpha$$

Hence, the kinetic energy of the electron is greater than that of the alpha particle.

Q30 A glass lens of refractive index 1.5 is placed in a trough of liquid. What must be the refractive index of the liquid in order to make the lens disappear?

Solution:- The lens will not be visible if no refraction occurs at the liquid−glass interface. This means that the incident ray should go through the glass without any deviation. For this condition to be fulfilled, the refractive index of the liquid must be equal to 1.5.

Q31 A converging and diverging lens of equal focal length are placed co-axially in contact. What is power and focal length (P=0 , f= Infinite)

Q32 State the reason, why heavy water is generally used as a moderator in a nuclear reactor.

Solution:- In nuclear reactors, heavy water is generally used as a moderator because unlike normal water, which absorbs neutron, it slows down neutron without absorbing it.

Q33 How does the fringe width of interference fringes change, upon the whole apparatus of Young's experiment is kept in a liquid of refractive index 1.3?

Solution:- The fringe width will decrease.

$$\text{Fringe width} = \frac{\lambda D}{d}$$

When light enters a denser medium, its wavelength decreases by a factor 1.3 and hence the fringe width also decreases by a factor 1.3.

Q34 Why reflecting type telescope prefer over refrecting type ?

Image is bright, Easy to construct mirror, no chromatic aberration, low cost

Q35 Calculate energy released by fission of 1 kg of U-235(Energy released per fission =200MeV

$Q = ((6 \times 10^{23}) \times 200)/235 = 5.1 \times 10^{26}$ MeV

Q36 Write the following radiations in ascending order with respect to their frequencies: X-rays, microwaves, UV rays and radio waves.

Solution:- The given radiations can be arranged in ascending order with respect to their frequencies as:

Radio waves < Microwaves < UV rays < X-rays

Q37 Define potential barrier and depletion region

During formation of P N junction the electrons will diffuse from n region to p region and holes will diffuse from p to n. This form recombination of charge carrier and immobile ions are collected at a junction this cause potential barrier

The region of immobile ions near junction is called depletion region.

Q38 You are given following three lenses. Which two lenses will you use as an eyepiece and as an objective to construct an astronomical telescope?

Lens	Power (P)	Aperture (A)
L1	3D	8 cm
L2	6D	1 cm
L3	10D	1 cm

Solution:- For constructing an astronomical telescope, the objective should have the maximum diameter. Of the three lenses given, L1 has the maximum diameter.

The eyepiece should have the highest power for better magnification. Therefore, we use lens L3.

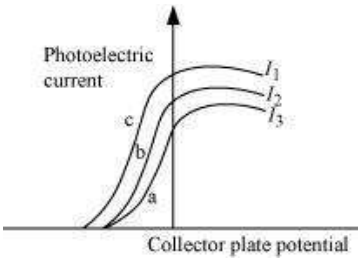
Q39 (a)Two stable isotopes of lithium Li-6 and Li -7 have respective abundances of 7.5% and 92.5%. These isotopes have masses 6.01512 u and 7.01600 u, repectively. Find average atomic mass

Average Atomic mass = $(m_1x_1 + m_2x_2)/ x_1 + x_2 = 6.941u$

(b)Two nuclei have mass numbers in the ratio 1: 2. What is the ratio of their nuclear densities?

Solution:- Nuclear density is independent of mass number. Hence, both the atoms have the same nuclear density.

Q40 The figure shows a plot of three curves a, b, c, showing the variation of photocurrent vs collector plate potential for three different intensities I_1, I_2 and I_3 having frequencies v_1, v_2 and v_3 respectively incident of a photosensitive surface. Point out the two curves for which the incident radiations have same frequency but different intensities.



Solution:- Curves *a* and *b* have the same frequency but different intensities.

Q41 What type of wave front will emerge from a (i) point source, and (ii) distance light source?

Solution:

(i) For point source, wave front will be spherical.

(ii) For a distant light source, the wave fronts will be plane wave fronts.

Q42 When an electron orbiting in hydrogen atom in its ground state moves to the third excited state. Show how the de Broglie wavelength associated with it would be affected

$$\lambda = \frac{h}{mv}$$

V is inversely proportional to λ . hence deBroglie wavelength directly proportional to n de Broglie wavelength will increases three times

Q43 (a) When is H_a Lines in the emission spectrum of hydrogen atom obtained?

Line of longest wavelength of Balmer series is called H_a.

(b) Is it possible for the electrons to have different energies. But same orbital angular momentum

Both energy and angular momentum depends on n so for different energy different angular momentum

Q44 (a) What is speed of light in medium whose critical angle is 45^0

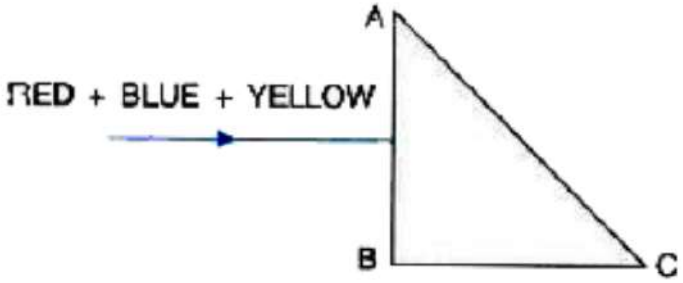
2.1X 10^8 m/sec

(b)Name the phenomenon based on total internal reflection

Mirage, Optical Fibre, Sparkling of Diamond, shinning of air bubble

Q45.

A beam consisting of red, blue and yellow colours is incident normally on the face AB of an isosceles right angled prism ABC as shown in Fig. 6.5. Complete the diagram to show the refracted and the emergent rays. Given that the critical angle of glass-air interface for yellow colour is 45°



Blue will suffer TIR, Red will emerge out from face AC where as Yellow will graze on face AC(Concept- Light of minimum refractive index need maximum critical angle to it will always comes out from face AC)

Q46 Which part of electromagnetic spectrum is used in radar systems?

Solution:- The microwave range of electromagnetic spectrum is used in radar systems.

Q47 Calculate the speed of light in a medium whose critical angle is 30°.

Solution:

Speed of light in the medium $= \dfrac{\text{Speed of light in air}}{\text{Refractive index of the medium with respect to air}}$

$$= \frac{3\times10^8 \text{ m/s}}{\left(\frac{1}{\sin 30^\circ}\right)}$$

$$= \frac{3\times10^8 \text{ m/s}}{2}$$

$$= 1.5\times10^8 \text{ m/s}$$

Q48 Why band gap must be at least 1.8 eV for LED

The photon of visible light varies about 1.8eV to 3eV, Hence for visible LED's the semiconductor must have 1.8 eV atleast

Q49 **(a)**Write the expression for Bohr's radius in hydrogen atom.

Solution:- The expression for Bohr's radius in hydrogen atom is $a_0 = \frac{h^2 \varepsilon_0}{\pi m e^2}$.

a_0= 0.529 x 10^{-10}m

(radius is always proportional to n^2)

(b) What is value of angular momentum in the second orbit?

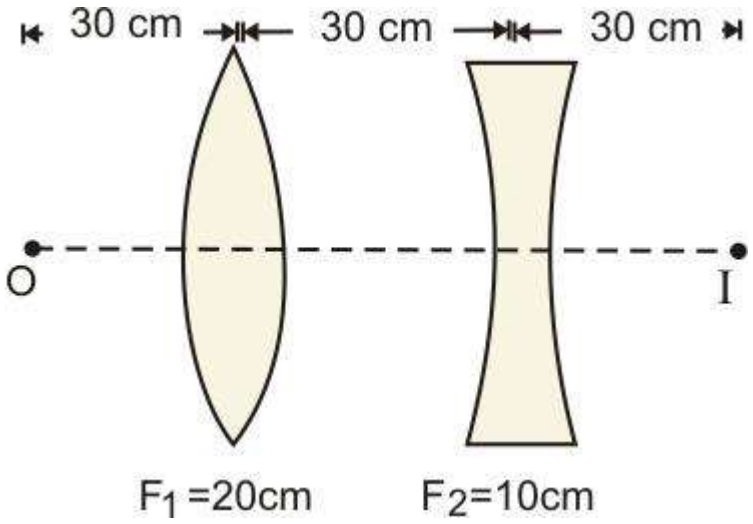
L= nh/2л=2h/2л=h/л

Q50 A convex lens of focal length 20 cm and a concave lens of focal length 15cm are kept 30cm apart with their principal axes coincident. When an object is placed 30cm in front of the convex lens, calculate the position of the final image formed by the combination. Would this result change if the object were placed 30cm in front of the concave lens? Give reason.

We have given,

$f_1 = 20cm$ = focal length for convex lens

$f_2 = 15cm$ = focal length for concave lens



Now,

The image formed by the convex lens can be determined as -

$$\frac{1}{f_1} = \frac{1}{v} - \frac{1}{u} \qquad (\because u = +30)$$

So,

$$\frac{1}{20} = \frac{1}{v} + \frac{1}{30}$$

$$\frac{1}{v} = \frac{1}{20} - \frac{1}{30}$$

$$\frac{1}{v} = \frac{30 - 20}{20 \times 30}$$

$$\frac{1}{v} = \frac{10}{600}$$

$$v = \frac{600}{10}$$

$$v = 60cm$$

Now, image distance for the concave lens, we have u = +30cm for concave lens

$$\frac{1}{f_2} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{-15} = \frac{1}{v} - \frac{1}{30}$$

$$\frac{1}{v} = \frac{1}{-15} + \frac{1}{30}$$

$$v = -30cm$$

therefore, $v = -30cm$

Hence, according to the principle of reversibility, the result will not change, if the object is placed 30cm in front of the concave lens.

(By mistake in diagram focal length of concave is given as 10cm)

(b) A screen is placed 90 cm from an object. The image of the object on the screen is formed by convex lens at two different locations separated by 20 cm. Find focal length D=90 cm x=20cm

Formula to find $f=(D^2-x^2)/4D$ = 21.4 cm

Q51 (a) Sn,C,Si and Ge are all group 14 elements. Yet, Sn is a conductor, C is an insulator while Si and Ge are semiconductors Why?

It is because C has band gap 5.4ev while Si and Ge is of the order of 1 ev while sn is having 0eV.

(b) What type of semiconductor is formed when

(i) Germanium dopped with indium – Ptype
(ii) Silicon dopped with Bismuth – N type

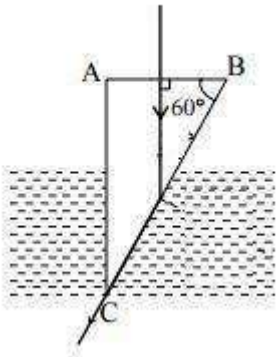
Q52 (a) How are X-rays produced?

Solution:- X-rays are produced when inside a vacuum tube high energy electrons emitted by the cathode collides with the anode (usually made of tungsten, copper, etc.)

(b)Name of physical quantity which remains same for microwaves of wavelength 1 mm and UV radiations of 1600 Å in vacuum.

Solution:- Both microwaves and UV rays are a part of the electromagnetic spectrum. Thus, the physical quantity that remains same for both types of radiation will be their speeds, equal to *c*.

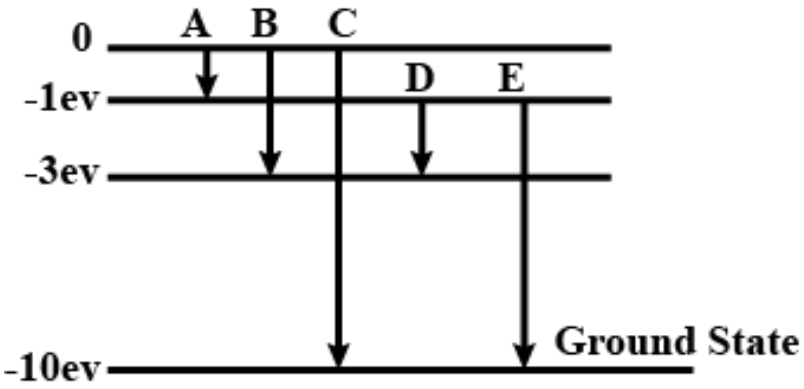
Q53 A ray of light is incident normally on the face AB of a right angled glass prism of refractive index $n_g = 1.5$. The prism is partially immersed in a liquid of unkown refractive index. Find the value of refractive index of the liquid so that the ray grazes along the face BC after refraction



$n = n_l/n_g = \sin i_c/\sin 90$ given $i_c = 60^0$ hence $n_l = 1.3$

Q54. The energy level of an atom of element X are as shown. Which one of the level transitions will result in the emission of photons of wavelength 620nm

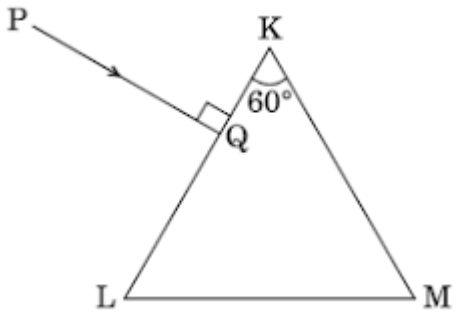
Solution: $E=hc/\lambda = 12400/6200 = 2eV$ hence transition D will -1-(-3) =2eV result in emission of 620nm



Q55 Define the term 'stopping potential' in relation to photo-electric effect. On what factors it depends

Solution:- If we increase the negative potential of the collector, the photoelectric current decreases rapidly. At a certain critical value of the negative potential of the collector, the photoelectric current becomes zero. This potential is called stopping potential or cut-off potential and it depends on the frequency of the incident radiation, but independent of its intensity.

Q56 A triangular prism of 60^0 is made up of transparent material of refractive index $2/\sqrt{3}$. A ray of light is incident normally on the face KL as shown . Trace the path of ray calculate angle of emergence and deviation



Angle of incidence will be 60^0 on face KM so it will act as critical angle hence

Sin 60^0/sin r $=n_a/n_g$ $=1/(2/\sqrt{3})$ $=\sqrt{3}/2$ so that sin r =1 hence r=90^0

Angle of emergence =90^0

Angle of deviation =30^0

Q57 Write any two characteristic properties of nuclear force.

Solution:

Characteristic properties of nuclear force are

(i) It does not depend on the electric charge.

(ii) It is the strongest force in nature.

(iii) It is a very short range force.

(iv) The nuclear force is only felt among hadrons. At much smaller separations between nucleons the force is very powerfully repulsive, which keeps the nucleons at a certain average separation. Beyond about 1.7 femtometer (fm) separation, the force drops to negligibly small values.

Q58 What happens to the width of depletion player of a p-n junction when it is (i) forward biased, (ii) reverse biased? Which are two important process involve in formation of PN junction.How does change in temperature affect conductivity of semiconductors

Solution:

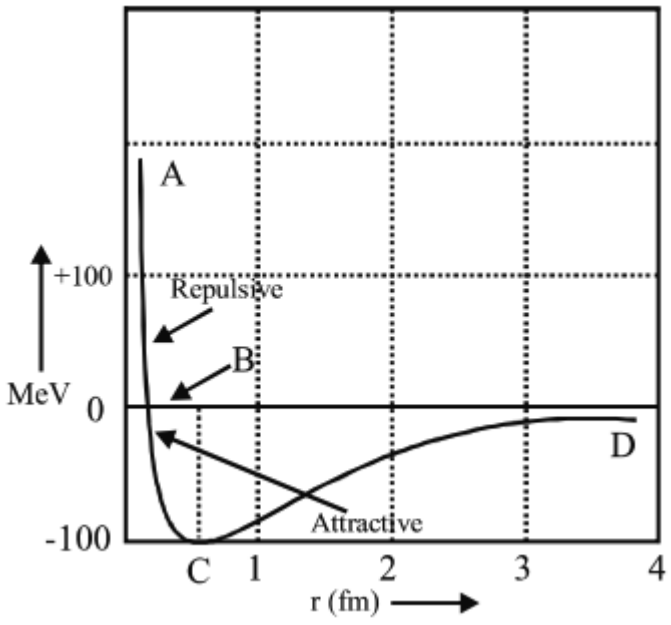
(i) In forward bias, the width of the depletion layer decreases.

(ii) In reverse bias, the width of the depletion layer increases.

Two process are diffusion and drift

Conductivity increases with temperature

Q59 Draw a graph showing the variation of potential energy between a pair of nucleons as a function of their separation. Indicate the region in which force is attractive and repulsive

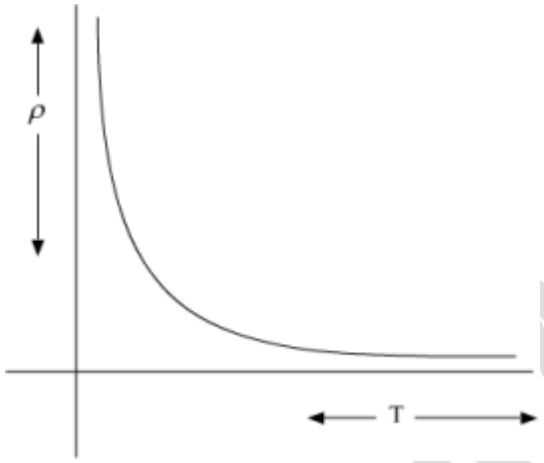


Q60 In YDS with light of wavelength λ the intensity at a point is K. What is intensity of light at point where path difference is λ/4?

$I = 4I_0 \cos^2\varphi/2$ for $\lambda/4$ $\varphi = \pi/2$ hence $I = 2I_0$.

Q61 Show on a graph, the variation of resistivity with temperature for a typical semiconductor.

Solution:- The following curve shows the variation of resistivity with temperature for a typical semiconductor.



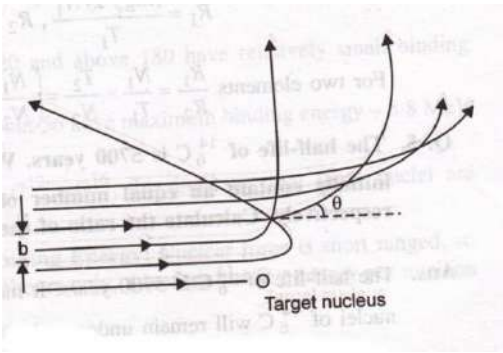
This is because, for a semiconductor, resistivity decreases rapidly with increasing temperature.

Q62 Is the speed of light in glass independent of color of light? If not which of the two colors red and violet travel slower in glass

Speed of light depends on color .Violet travel slower

Q63 The trajectories, traced by different $\propto$ –particles, in Geiger-Marsden experiment were observed as shown in the figure.

(a) What names are given top the symbols '*b*' and 'θ' shown here.
(b) What can we say about the values of *b* for (*i*) $\theta = 0^o$ (*ii*) $\theta = \pi$ radians.



b represent impact parameter, θ scaterring angle $\theta = 0$ the impact parameter will be maximum. Represent atomic size $\theta = \pi$,b will be minimum and it represent nuclear size

Q64 Under what condition does a biconvex lens of glass having a certain refractive index act as a plane glass sheet when immersed in a liquid?

Solution:- A biconvex lens will act like a plane sheet of glass if it is immersed in a liquid having the same index of refraction as itself. In this case, the focal length $1/f = 0$ or $f \to \infty$.

Q65 In a double slit experiment using light of wavelength 600nm, the angular width is 0.1^0. Find spacing between two slits

Angular width = λ/d so

spacing d= λ/angular width = 3.44×10^{-4} m

Q66 State de-Broglie hypothesis.

Solution:- de-Broglie Hypothesis states that—

> Moving object sometimes acts as a wave and sometimes as a particle; or a wave is associated with the moving particle, which controls the particle in every respect. This wave associated with the moving particle is called matter wave or de Broglie wave, its wave length is given as
>
> $$\lambda = \frac{h}{mv}$$
>
> Where
>
> $h \to$ planck's constant
>
> $m \to$ mass of the object
>
> $v \to$ velocity of the object

Q67 When monochromatic light travels from one medium to another, its wavelength changes but frequency remain same. Explain

Frequency is characteristics of source and does not depends on medium. Light reflects and refract due to the interaction of incidence light with atoms of medium. These atoms always take up the frequency of the incident light which force them to vibrate and emits light of same frequency.

Q68 Write the relationship between angle of incidence 'i', angle of prism 'A' and angle of minimum deviations for a triangular prism.

Solution:- The relation between the angle of incidence I, angle of prism, A and the angle of minimum deviation, Δ_m for a triangular prism is given as is given by

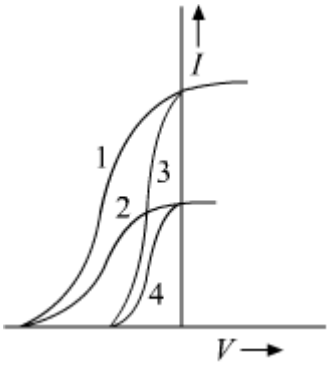
$$i = \frac{A + \Delta_m}{2}$$

.

Q69 How does the fringe width of interference fringes changes when whole apparatus in immersed in liquid of refractive index 4/3

It will decrease and will become ¾ of original

Q70 The given graph shows the variation of photo-electric current (I) versus applied voltage (V) for two difference photosensitive materials and for two different intensities of the incident radiations. Identify the pairs of curves that correspond to different materials but same intensity of incident radiation.



Solution:- Curves 1 and 2 correspond to similar materials while curves 3 and 4 represent different materials, since the value of stopping potential for the pair of curves (1 and 2) & (3 and 4) are the same. For given frequency of the incident radiation the stopping potential is independent of its intensity.

So, the pairs of curves (1 and 3) and (2 and 4) correspond to different materials but same intensity of incident radiation.

Q71 Which of the following waves can be polarized (i) Heat waves (ii) Sound waves? Give reason to support your answer.

Solution:- Heat waves can be polarized because heat waves are transverse waves whereas sound waves cannot be polarized because sound waves are longitudinal waves.

Q72 A concave lens of refractive index 1.5 is immersed in a medium of refractive index 1.65. What is nature of the lens?

It will act as convex (concave will behave as convex and vice versa)

Q73 (a) For which color the magnifying power of simple micro scope is highest and lowest?

Highest for violet and lowest for red

.(b) Why focal length of eye lens and objective lens must be smaller in compound microscope

Magnification is inversely proportional to focal length so to get highest magnification they must be as small as possible

Q74 How does focal length of a lens change when red light incident on it replaced by violet light

Refractive index of violet is greater than red so focal length of violet is less than red

Q75 For astronomical telescope of magnification 5 for relaxed eye and distance between objective and eye lens is 36 find focal length of objective and eye lens

$F_0/f_e = 5$ and $f_0 + f_e = 36$ solving $f_0 = 30$ and $f_e = 6$

Q76 Why microwave is suitable for RADAR and aircraft navigation

Due to their short wavelength or high frequency

Q77 Name the electromagnetic wave which maintain the earth's warmth. Give two applications of it

Infrared rays

To treat muscular strains, to reveal the secret writings, dehydrated fruits,solar cooker

Q78 How electromagnetic waves are produced by an oscillating charge?

An oscillating charge produces an oscillating electric field which in tern produces oscillating magnetic field and process continue.

Q79 A beam of light consisting of two wavelength 650nm and 520nm to obtain interference at 1.2 m away. The separation between the slits is 2mm.Find which two fringes will coincide of the two wavelength(at least distance)

$N_1\lambda_1 = N_2\lambda_2$

For $N_1 = n$ $N_2 = n+1$

Solving it n=4 hence 4 and 5 will coincide

Q80 A convex lens is placed in contact with a plane mirror. A point object at a distance of 20 cm on the axis of this combination has its image coinciding with itself. What is the focal length of the lens?

Solution:- Here, the convex lens is in contact with a plane mirror and the image distance is equal to the object distance. This is possible only when the point object is placed at the centre of the curvature of the lens.

We use the relation f=R2, where *R* is the distance between the centre of the curvature and the pole and *f* is the focal length.

Here, *R* = 20 cm

∴ Focal length of the lens = 20/2 = 10 cm

Q81 (a)What will happen if two sources will not be coherent?

We will not get sustained interference and intensity at a point will go on changing.

(b)Is Huyghen principle valid for sound wave

Yes they are valid

© "In YDS we get both interference and diffraction" Comment

Yes in YDS we get both interference and diffraction. There is always bending of light with superposition of coherent light sources.

Q82 When light travel from rarer to a denser medium, the speed decreases. Does this decrease in speed imply a reduction in the energy carried by the wave

No as frequency remain same energy also remain same

Q83. How does the intensity of central maxima change when we double the width of slit

Solution: It becomes four times

Q84. A photon and proton have the same de-Broglie wavelength λ. Prove that energy of photon is (2mcλ/h) times the kinetic energy of the proton

Energy of Photon =hc/λ

For proton λ=h/mv

mv= h/λ

Kinetic energy = $1/2mv^2 = p^2/2m$ ½ $h^2/m\lambda^2$ solving it we get desired result

Q85. When light travel from a rarer to denser medium, the speed decreases. Does this decrease in speed imply a decrease in the energy carried by the light wave? Justify your answer.

Solution: Energy depends on amplitude and frequency and not on speed so no change.

Q86. Suggest a suitable method to invert an image without change in size and without deviation from its original direction of view.

Q87.Why can't we see clearly through fog? Name the phenomena.

Solution: Because it scatters light. Scattering of light.

Q88. For the same angle of incidence , the angle of refraction in two media A and B are 25^0 and 35^0 respectively. In which one of the two media is the speed of light lesser?

Speed of light is lesser in media A

Q89. Complete the following nuclear reaction

$_5B^{10} + _0n^1 \rightarrow _2He^4 + ...$

Solution $_5B^{10} + _0n^1 \rightarrow _2He^4 + _3Li^7$

Q90. Work function of the following metals is given Na = 2.75eV, K =2.3 eV , Mo =4.17eV and Ni = 5.15eV

Which of these metals will not give a photoelectric emission with 3300 A

$E = hc/\lambda = 3.76$

Only those metals with less than this work function will give

Na and K will show where as Mo and Ni will not show.

Q91. Why does white light disperse when passed through a glass prism ?

Solution: It is because a glass prism offers different refractive index to different

wavelength of light.

Q92. Why Si and GaAs preferred materials for solar cell?

There are various reasons

(i) Band Gap
(ii) High optical absorption
(iii) Electrical conductivity
(iv) Availability of raw materials
(v) cost

Q93.Why does reverse current shows a sudden increase at the critical voltage

At critical voltage or breakdown voltage a large number of covalent bond will break resulting in the increase of large number of charge carriers. Hence current increase at critical voltage.

Q94. Give two advantage of LED over conventional incandescent lamps

Low operational voltage

Long life

Fast on off switching , no warm up time

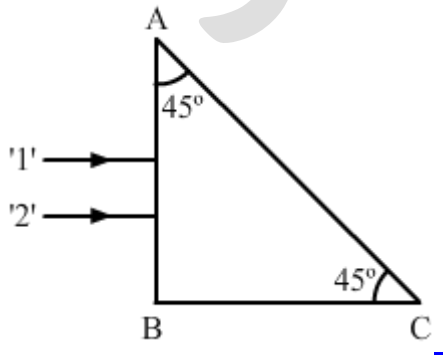
Q95.Name the three important process involved to generate emf in solar cell

(i) Generation: generation of electron hole pair near junction
(ii) Separation: electrons in n side holes in p side due to electric field
(iii) Collection: electrons collected by front contact of n side and holes by back contact of p side

Q96. Why are elemental dopants for silicon or germanium usually chosen from group 13 or group 15?

The size of dopant atoms should be such as not to distort the pure semiconductor lattice structure and yet contribute a charge carrier on forming covalent bonds with Si or Ge.

Q97. Two monochromatic rays of light are incident normally on the face AB of an isosceles right-angled prism ABC. The refractive indices of the glass prism for the two rays '1' and '2' are respectively 1.35 and 1.45. Trace the path of these rays after entering the prism.



Solution; Refractive index n= 1/sin i_c = 1.414. the ray will transmitted through face AC if $i<i_c$ this condition will be satisfied for n<1.414 hence 1 will transmit and 2 will suffer total internal reflection.

Q98. When monochromatic light of wavelength λ illuminates a metal surface then stopping potential for photo electric current is $3V_0$. If wavelength changes to 2λ then stopping potential becomes V_0 .Find the Threshold wavelength for photo electric emission

Sol $\frac{hc}{\lambda} - \phi_0 = 3V_0e$ .....(1)

$\frac{hc}{2\lambda} - \phi_0 = V_0e$ .....(2)

eq. (1) – eq.(2) : $\frac{hc}{\lambda}\left[1-\frac{1}{2}\right] = 2V_0e$

$\frac{hc}{2\lambda} = 2V_0e \Rightarrow \lambda = \frac{hc}{4V_0e}$

$\Rightarrow \frac{hc}{2\lambda} = \phi + \frac{hc}{4\lambda}$

$\Rightarrow \phi = \frac{hc}{4\lambda} = \frac{hc}{\lambda_0} \Rightarrow \lambda_0 = 4\lambda$

Q99. Welders wear special glass goggles while working . Why?

Solution: This is because the special glass goggles protect the eyes from large amount of ultraviolet radiations produced by welding arcs .

Q100. A converging lens has a focal length of 20 cm in air. It is made of a material of refractive index 1.5. If it immersed in water of refractive index 4/3, what will be the new focal length ?

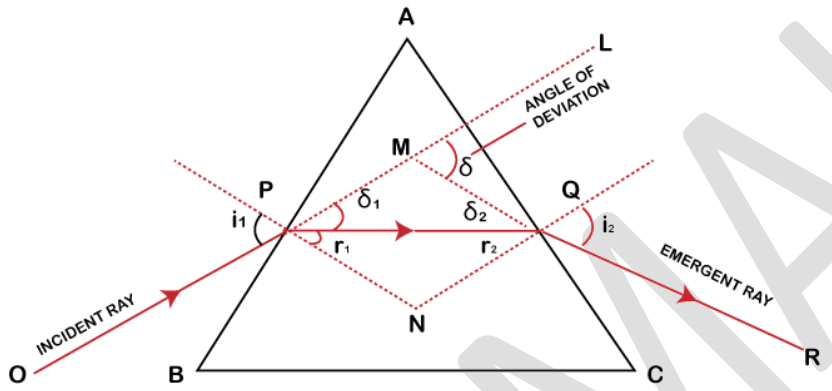
$F_{new} = (n_g - 1)/(n_g/n_l - 1) \times f = \left(\left(\frac{1.5-1}{\frac{1.5}{(4/3}-1)}\right) \times 20 = 80\right)$ cm.

**********Wish You Good Luck and all the best**********

Case Study Practice

Case Study: Refraction through a prism

A prism is a transparent medium enclosed by two plane refracting surfaces. When light enter through one of the face , it refract and then again incident on the other face and finally comes out. The angle between incident ray and emergent ray is called angle of deviation. Angle of deviation is same for two values of angle of incidence i_1 and i_2.they may be interchanged.If we change angle of incidence angle of deviation also changes and for particular value of angle of incidence it attain minimum value. When white light enter through prism then white light disperse into seven colours.



Q1. When a ray of yellow colour passes through a prism and suffer minimum deviation, then

(a) Angle of incidence is smaller than angle of emergence
(b) Angle of incidence is greater than the angle of emergence
(c) Sum of angle of emergence and incidence is equal to 90^0
(d) Angle of incidence is equal to angle of emergence

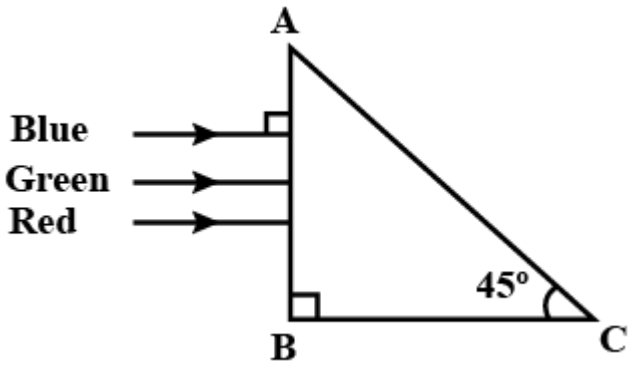
Q2.If angle of minimum deviation is 40^0 and angle of prism is 60^0 then the angle of refraction will be

(a) 30^0
(b) 60^0
(c) 100^0
(d) 120^0

Q3.A ray of light passes through an equilateral prism in such a manner that the angle of incidence is equal to angle of emergence and each of these angles is equal to ¾ of the angle of prism. The angle of deviation is

(a) 45^0
(b) 39^0
(c) 20^0
(d) 30^0

Q4.A beam of white light is incident normally on a right angled prism. The refractive index of the prism for red, Yellow and blue colours are 1.39,1.45 and 1.51 respectively . The colours which will not pass through face AC of prism are



(a) Yellow and blue
(b) Yellow and red
(c) Red and blue
(d) None of them

5. If angle of prism is 2^0 and refractive index is 3/2 then angle of deviation will be

(a) 1^0

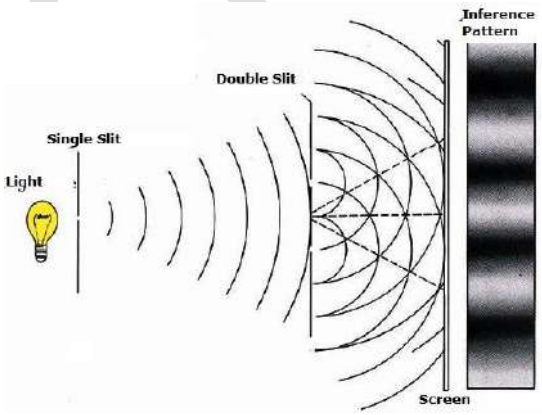
(b) 2^0

(c) 3^0

(d) 4^0

Case Study: YDSE

According to Huyghen ,light is a wave, It is proved experimentally by YDSE .In it division of wavefront takes place



If a narrow slit is illuminated by a monochromatic source of light sends out disturbance in all direction which when reach double slit they are in same phase and frequency so their superposition will give interference as they act like two coherent sources.Central fringe is always bright in this pattern.

(1) Young's experiment proves which of the following fact

(i) Light is made up of particles

(ii) Light is made up of waves

(iii) Light is made up of neither particles nor waves

(iv) Fringe width does not depends upon the spacing between slits

(2) In YDSE

(i) Only interference occurs

(ii) Only diffraction occurs

(iii) Both interference and diffraction occurs

(iv) None of above

(3) In white light interference , nearest to the central bright fringe ,will have which of the following colours

(i) Violet

(ii) Yellow

(iii) Red

(iv) Green

(4) In YDSE , bright fringes are of

(i) Equal widths and unequal intensities

(ii) Unequal widths and equal intensities

(iii) Equal widths and equal intensities

(iv) Unequal widths and unequal intensities

(5) YDSE first performed in air then performed in water , the fringe width

(i) Will remain same

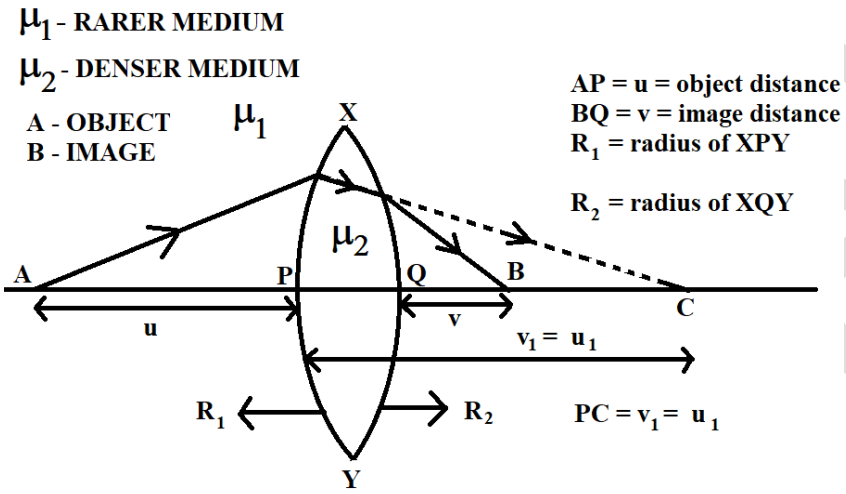
(ii) Will decrease

(iii) Will Increase

(iv) Will be infinite

3 Case Study: Lens Maker's Formula

$$\frac{1}{f} = (n-1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$



Lens maker's formula gives relation in focal length with refractive index and radius of curvature of lens. Above ray diagram shows the path of ray passes through the lens it suffer refraction on two surfaces first rarer to denser and second denser to rarer.final image will form at B.C will act as virtual object for second surface.

Answer the following questions based on above topic

(1) If red light replaced with violet light then how focal length will vary

(v) Focal length will increases

(vi) Focal length will decreases

(vii) Focal length will remain same

(viii) May increase or decreases

(2) If convex lens is submerged in a liquid whose refractive index is more than refractive index of lens then

(i) Convex will behave as plane glass

(ii) Convex will behave as concave

(iii) Convex will behave as convex only

(iv) Convex may behave as convex or concave

(3) If focal lens of lens is equal to f=2R/3 for a equi-convex lens of radius R then refractive index of material of lens is

(i) 1.5

(ii) 1.25

(iii) 1.75

(iv) Zero

(4) If we cut lens of focal length f from middle vertically then new focal length of each part will be

(6) Remain f

(7) Become 2f

(8) Become f/2

(9) Become infinite

(5) A biconvex lens is made from glass of refractive index 1.5 and radius of curvature of both the surface of lens is 20 cm. The incident ray parallel to principal axis will be focused at a distance L from lens on principal axis then L will be equal to

(i) 10cm

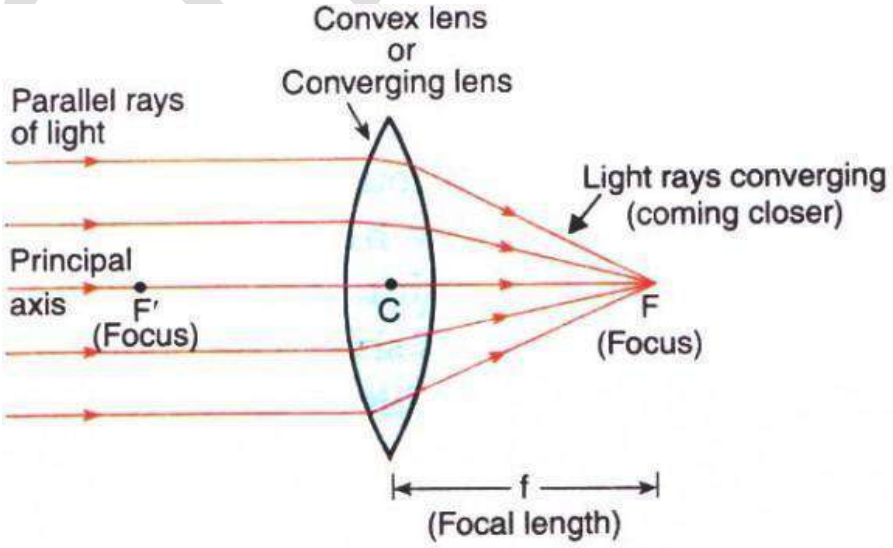
(ii) 20cm

(iii) 40 cm

(iv) 20/3 cm

4.CASE Study:

15. A lens is a portion of a transparent material with two refracting surfaces such that at least one is curved with refractive index of its material being different from that of the surrounding .



1. If the lens of focal length f is cut into equal parts by a vertical plane then focal length of each part will be?

   a) f **b) 2f**

   c) f/2 d) infinity

2. If lens of focal length f is cut in to equal parts by horizontal plane then focal length of each part will be?

   a) **f** b) 2f

   c) f/2 d) infinity

3. Focal length of lens does not depends on

   a) refractive index of glass b) wavelength

   c) radius of curvature d) position of object

4. If half portion of a lens is covered by black paper then which of following will change

   a) focal length b) power

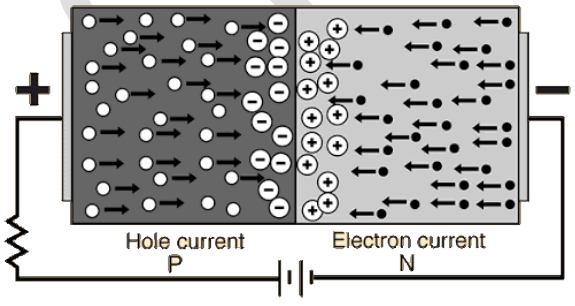
   c) intensity of image d) size of image

5. If convex and concave lens of equal focal length are placed in contact with each other then effective focal length of combination will be

   a) Zero b) Infinite

   c) 2f d) none of above

CASE Study Semiconductor:



It is a single crystal of Ge or Si doped in such a manner that one half portion of it acts as P- type and other half acts as N-type.as soon as P-N junction is formed, the majority carrier begin to diffuse from the regions of high concentration to regions of low concentration. Electrons form N

region to P and holes from P to N where they combine with the electrons and get neutralised. This process is called electron -hole recombination. The P region near the juction is left with immobile -ve ions and n regions near the junction left with +ve ions .This region of immobile ions is called the depletion region. The accumulation of opposite charges will give rise to potential difference across junction called barrier field.

1. A potential barrier of 0.50 V exists across a P-N junction. If the depletion region is 5.0×10^{-7} m wide, the intensity of the electric field in this region is -
   (A) 1.0×10^{6} V/m (B) 1.0×10^{5}\ V/m (C) 2.0×10^{5} V/m (D) 2.0×10^{6} V/m
2. If no external voltage is applied across P-N junction, there would be -
   (A) No electric field across the junction

   (B)An electric field pointing from N-type to P-type side across the junction

   (C) An electric field pointing from P-type to N-type side across the junction

   (D) A temporary electric field during formation of P-N junction that would subsequently disappear
3. No bias is applied to a P-N junction, then the current -
   (A) Is zero because the number of charge carriers flowing on both sides is same

   (B) Is zero because the charge carriers do not move

   (C) Is non-zero (D) None of these
4. Which of the following statements is correct ?

   (A) The deplection region of P-N junction diode increases with forward biasing

   (B) The depletion region of P-N junction diode decreases with reverse biasing

   (C) The depletion region of P-N junction diode does not change with biasing

   (D) The deplection region of P-N junction diode decreases with forward biasing
5. When reverse bias in a junction diode is increased, the width of depletion layer -

   (A) increase (B) decreases (C) does not change (D) fluctuate

SUPER TEST SERIES

Super 5 Test Series

Topic: Optics and EMW

TERM II 2021-22

Time : 2 Hrs. **CLASS - XII, SUBJECT– PHYSICS (042)**
M.M. 35

DR. MUKESH SHRIMALI

General Instruction:

- **(i)** **There are 12 questions in all. All questions are compulsory**
- **(ii)** **This question paper has three sections Section A, Section B and Section C**
- **(iii)** **Section A consist three questions of two marks each, Section B consists eight questions of 3 marks each , section C consists one case study based question of 5 marks.**
- **(iv)** **There is no overall choice. However an internal choice has been provided in one question of two marks,and two questions of three marks. You have two attempt only one of the choices in such questions**
- **(v)** Use of calculators is not permitted. However, you may use log table if necessary

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Section – A(2 marks)

Q1. State principle and working behind communication through optical fibre through labeled diagram. Why this communication is considered to be the best?

Q2. A plane electromagnetic wave of frequency 25Mhz travels in free space along the x direction. At a particular point in space and time E= 6.3 j V/m . What is magnitude and direction of B (Magnetic field) at this point

OR

The magnetic field in a plane electromagnetic wave is given by $B_y = 2 \times 10^{-7} \sin (0.5 \times 10^3 x + 1.5 \times 10^{11} t)$ T. What is wavelength and frequency of the wave?

Q3. A double convex lens is made of a glass of refractive index 1.55, with both faces of the same radius of curvature. Find the radius of curvature required if the focal length is 20 cm.

Section – B(3 marks)

Q4. (a)Define power of lens. Deduce relation for equivalent focal length if two lens of focal length f_1 and f_2 kept in contact coaxially

(b)A screen is placed 100 cm from an object. The image is formed on the screen by a convex lens for two different locations of the lens separated by 20 cm. Calculate the focal length of the lens used

Q5. Calculate the electric and magnetic field produced by the radiation coming from 100Watt bulb at a distance of 3 m. Assume that the efficiency of the bulb is 2.5% and it is a point source.

Q6. Using Huyghen's principle, draw a diagram to show propagation of a wave front originating from a monochromatic point source then explain reflection and verify laws of reflection

OR

How is wave front defined? Using Huyghen's construction draw a figure showing the propagation of a plane wave refracting at a plane surface separating two media. Hence verify Snell's law of refraction.

Q7. (i)Define interference of light by explain young's double slit experiment and give condition of maxima and minima so obtained .Write condition to obtain sustained interference fringes.

(ii)In a double slit experiment the angular width of a fringe is found to be 0.2^0 on a screen placed 1 m away. The wavelength of light used is 600nm. What will be angular width of the fringe , if the entire apparatus is immersed in water of refractive index 4/3

Q8. Draw a schematic ray diagram of compound microscope to obtain real inverted and magnified image of object. then derive expression for its magnification

OR

(i) Draw a schematic diagram of a refracting telescope .Give expression for its magnification

(II)A small telescope has an objective lens of focal length 144cm and eye piece of focal length 2.5 cm. What is magnifying power and separation between the objective and the eye piece?

Q9. (i)Describe diffraction of light due to single slit. Explain formation of fringes obtained on the screen and plot showing variation of intensity with angle in single slit diffraction

(ii) Two slits are made one millimeter apart and the screen is placed one meter away>what is fringe separation when blue –green light of wavelength 500 nm is used. What should be width of each slit to obtain 10 maxima of the double slit pattern within the central maxima?

Q10.(i) (a)Explain refraction at a spherical surface when object lies in rarer medium in front of

convex spherical surface. Gives relation in refractive index, object and image distance

(b)Light from a pint source in air falls on a spherical glass surface (n=1.5 and radius of curvature =20 cm) The distance of the light source from a glass surface is 100cm. At what position the image is formed

Q11. Given below are some famous numbers associated with electromagnetic wave. State the

part of electromagnetic spectrum to which they belong

(i) 21cm(Wavelength emitted by atomic hydrogen in space)
(ii) 1057 Mhz (Frequency of radiation arising from two close energy levels in hydrogen)
(iii) 2.7 K (temperature associated with isotropic radiation big bang
(iv) 5890 -5896 A (double lines of sodium)
(v) 14.4 keV (energy of particular transition in Fe -57)

OR

Answer the following questions

(i) Optical and radio telescope are built on the ground but X rays astronomy is possible only from satellite orbiting the earth. Why?

(ii) Why orientation of the portable radio with respect to broadcasting station important?

(iii) If earth did not have atmosphere. Would its average temperature be higher or lower than what it is now?

(iv) What physical quantities is the same for X rays, red light and radiowave?

(v) A charged particle oscillates about its mean equilibrium position with a frequency of 10^9 Hz. What is frequency of EMW produced by oscillator?

(vi) Why electromagnetic wave carry energy and momentum?

Section – C(5 marks)

Case Study: Refraction

When a ray of light enters from one transparent medium in to other there is change in speed of light . This phenomenon is called refraction.The phenomenon of refraction of light obeys two laws

First: The incident ray, the refracted ray and the normal to the interface at the point of incidence all lies in the same plane

Second: The ratio of the sin of the angle of incidence and the sin of angle of refraction is constant for a given pair of media Sini/sin r =n

Answer the following question based on refraction

1. Which physical quantity will not change in refraction
   (a) Intensity
   (b) Frequency
   (c) Speed

(d) Wavelength

2. A magician during a show makes a glass lens with refractive index1.5 disappear in a trough liquid. What is refractive index of liquid
   (a) 3
   (b) 0
   (c) Infinite
   (d) 1.5
3. For the same angle of incidence, the angle of refraction in two media A and B are 25^0 and 35^0 respectively. In which one of the two media is the speed of light lesser?
   (a) Media A
   (b) Media B
   (c) Same in both media
   (d) Depends on intensity of light

4. Refractive index is highest for which of the following colours
   (a) Red
   (b) Violet
   (c) Green
   (d) Yellow
5. A tank is filled with a water to a height of 12.5 cm. The apparent depth is measured to be 9.4cm . Then refractive index will be
   (a) 1.5
   (b) 2.0
   (c) 1.33
   (d) 1

Super 5 Test Series

Topic: Dual Nature, Atom and Nuclie

TERM II 2021-22

Time : 2 Hrs. **CLASS - XII, SUBJECT– PHYSICS (042)**
M.M. 35

General Instruction:

(vi) There are 12 questions in all. All questions are compulsory
(vii) This question paper has three sections Section A, Section B and Section C
(viii) Section A consist three questions of two marks each, Section B consists eight questions of 3 marks each , section C consists one case study based question of 5 marks.
(ix) There is no overall choice. However an internal choice has been provided in one question of two marks,and two questions of three marks. You have two attempt only one of the choices in such questions
(x) Use of calculators is not permitted. However, you may use log table if necessary

Section – A(2 marks)

Q1. If the frequency of light incident on the cathode of photo-cell is increased, how will the following be affected

(i) Energy of the photoelectron
(ii) Photocurrent

Q2. In an experiment on alpha particle scattering by thin gold foil , draw a plot showing the number of particle scattered versus the scattering angle ɵ. Why is it that very less number of particle scattered above 90 degree.

OR

Draw a graph showing variation of potential energy between the pair of nucleons as a function of their separation. Indicate the regions in which the nuclear force is (i) attractive (ii) repulsive

Write two important conclusion which you can draw regarding the nature of nuclear forces.

Q3. A hydrogen atom is in its third excited state. How many spectral lines can be emitted by it before coming to the ground state?. In which transition spectral line of shortest wavelength be emitted?

Section – B(3 marks)

Q4. (a) Define cutoff potential and work function in relation to photoelectric effect.

(b)The work function of following metals is given

Na=2.75eV, K=2.3eV, Mo =4.17eV, Ni=5.15eV

(i)Which of these metals will not give a photoelectric emission for a radiation of wavelength 3300A from laser source placed 1 m away .

(ii) What will happen if laser is brought nearer and placed 50 cm away

Q5. Obtain an expression for the frequency of radiation emitted when a hydrogen atom de-excites from level n to level n-1. For large n, show that this frequency equals the classical frequency of revolution of the electron in the orbit.

Q6. Using Bohr's second postulates of quantization of orbital angular momentum show that the circumference of the electron in the nth orbital state in hydrogen atom is n times the de –Broglie wavelength associated with it.

OR

Draw a schematic arrangement of Geiger – Marsden experiment for studying α particle scattering by thin foil of gold. What are the observation and conclusion with special reference to distance of closest approach and impact parameter

Q7. (i)An electron and a proton , each have de –Broglie wavelength of 1.00nm. Find ratio of their momenta and compare Kinetic energy of proton with that of electron.

(ii)If deuterons and alpha particle are accelerated with same potential find ratio of de Broglie wavelengths of two.

Q8. (a)Three stable isotopes of neon Ne-20, Ne-21 and Ne-22 have respective abundances of 90.51%, 0.27% and 9.22%. The atomic masses of the three isotopes are 19.99u, 20.99u and 21.99 u respectively. Obtain the average atomic mass of neon

(b) The nuclear mass of Fe-56 is 55.85amu. Calculate its nuclear density.

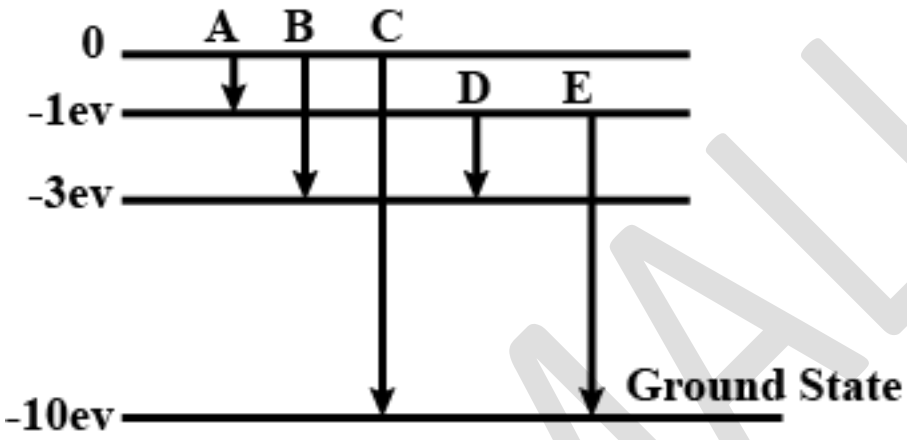
OR

(i)If 200 MeV of energy is released in the fission of single nucleus of U-235, How many fissions must occur to produce a power of 1 kW?

(II)Consider the radius of both deuterium and tritium to be approximately 1.5 X 10^{-15} m. What is Kinetic energy needed to overcome Coulomb repulsion?

Q9. (i)Using Bohr's postulates ,obtain expression for (i) KE (ii) potential energy of the electron in the stationary state of hydrogen atom. What is significance of negative total energy?

(ii) The energy level of an atom of element X are shown in the diagram which one of the level transition will result in the emission of photons of wavelength 620nm?



Q10.(i) Describe an experimental arrangement to study photoelectric effect . Explain effect of (i)

Intensity (ii) otential of photoelectric current

(iii) Use Einstein's photoelectric equation draw graph between stopping potential and frequency then explain how we determine (a)Planck's Constant (b) Work function from the graph

Q11. Explain briefly the reasons why wave theory of light is not able to explain the observed

features of photoelectric effect. How quantum theory justify these shortcomings?

OR

Using photon picture of light , show how Einstein photoelectric equation can be established . Write two features of photoelectric effect which can not be explain by wave theory.

Section – C(5 marks)

Case Study: Bohr Model of Atom

Bohr Modified Rutherford model to explain the line spectrum of hydrogen. According to Rutherford an electron moving in a circular orbit around nucleus is accelerating and it should emit radiation to lose energy. So radius would decreases and the electron would spiral in to nucleus. Bohr drawing inspiration form quantum theory and explain concept of stationary orbits.

Answer the following question based on refraction

1.What is angular momentum of electron in the second orbit of Bohr's model of hydrogen atom

(e) 2h/л
(f) Zero
(g) h/2л
(h) h/л

2.Which of the spectral series lies in Visible region

(e) Lyman
(f) Balmer
(g) Paschen
(h) Bracket

3. If total energy of Electron in second orbit is -3.4 eV then it potential energy will be
(a)3.4eV
(b)6.8eV
(c)-6.8eV
(d)Infinite

4.The wavelength of H_α Line of the Balmer Series is 6553A.Then value of Rydberg constant will be(in m^{-1})

(e) 1098 $x10^4$
(f) 2098 $x10^4$

(g) 3098 x10^4

(h) 4098 x10^4

5.If Orbital period in the groud state of hydrogen atom is T then in first excited state it will be

(e) 2T

(f) 4T

(g) T

(h) 8T

Super 5 Test Series

Topic: SEMICONDUCTOR

TERM II 2021-22

Time : 2 Hrs. **CLASS - XII, SUBJECT– PHYSICS (042)**
M.M. 35

DR. MUKESH SHRIMALI

General Instruction:

(xi) **There are 12 questions in all. All questions are compulsory**

(xii) **This question paper has three sections Section A, Section B and Section C**

(xiii) **Section A consist three questions of two marks each, Section B consists eight questions of 3 marks each , section C consists one case study based question of 5 marks.**

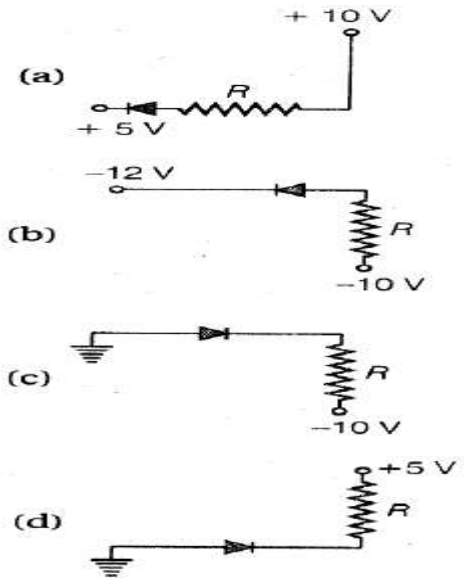
(xiv) **There is no overall choice. However an internal choice has been provided in one question of two marks,and two questions of three marks. You have two attempt only one of the choices in such questions**

(xv) Use of calculators is not permitted. However, you may use log table if necessary

Section – A(2 marks)

Q1. Why are elemental dopants for silicon and germanium usually chosen from group 13 or 15 ?

Q2. Identify which of the diodes are forward and reverse bias ?



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OR

What happens to the width of depletion layers of a P-N junction when it is (a) Forward bias (b) Reverse bias

Q3. When the voltage drop across a PN junction diode is increased from 0.65 to 0.70 V , the change in the diode current is 5mA. What is the dynamic resistance of the diode?

Section – B(3 marks)

Q4. (a)Find the maximum wavelength of electromagnetic radiation which can create a hole –electron pair in germanium. The band gap in germanium is 0.65eV.

(b) What type of extrinsic semiconductor is formed when (a) germanium is doped with indium? (b) Silicon is doped with bismuth ?

Q5. State with reason why a photodiode is usually operated at a reverse bias. Explain with help of circuit diagram its working and how it is used to detect the optical signal?

Q6. Describe briefly using the necessary circuit diagram, the three basic process which takes place to generate the emf in a solar cell when light falls on it

OR

(a)Write two important criteria required for the selection of a material for solar cell

(b) Why are Si and GaAs preferred materials for solar cell?

Q7. A semiconductor has equal electron and hole concentration of 2×10^8 /m^3. On doping with a certain impurity, the hole concentration increases to 4×10^{10}/m^3

(a) What type of semiconductor is obtained on doping?

(b) Calculate new electron hole concentration

(c) How does energy gap vary with doping

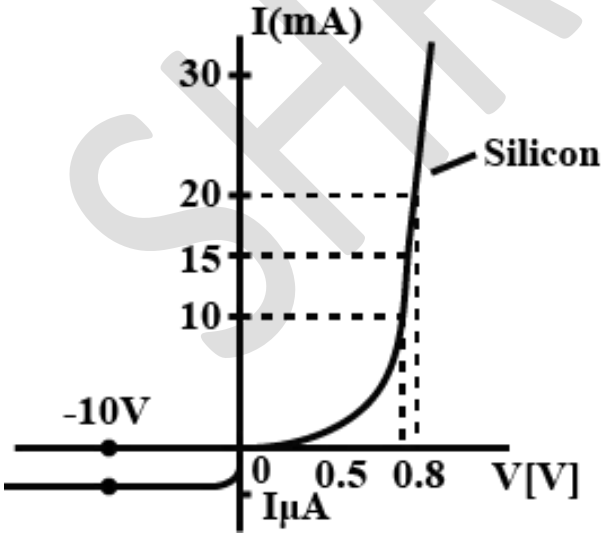
Q8. How is light emitting diode fabricated? Briefly state its working. Write any two important advantage of LED over the conventional incandescent low power lamps

OR

(i) Which semiconductor are preferred to make LEDs and why?

(II)How we produce different colors of light in LED
(iii) Why LED's must have atleast 1.8eV band gap

Q9. The V-I characteristics of a silicon diode is as shown Calculate the resistance at I=15mA and V= -10V (Given At at 0.7V current is 10 mA and at 0.8 V current is 20mA)



Q10.(i) (a)Can we take one slab of P type semiconductor and physically join it to another n type

semiconductor

(b)Explain formation of PN junction and important process involve in it.

Q11. What are energy bands? Draw suitable diagrams and Write any two distinguish features

between conductor, semiconductor and insulator on the basis of energy band diagram.

OR

Distinguish between intrinsic and extrinsic semiconductor. Give reason why P type and N type are electrically neutral. Explain modification in energy band diagram due to doping.

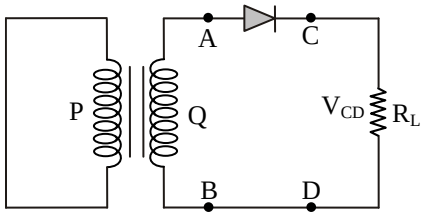
Section – C(5 marks)

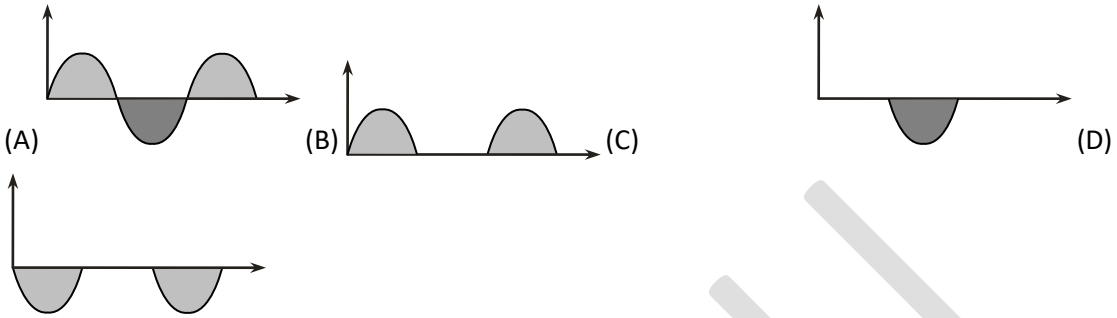
Case Study: Rectifier

A rectifier is a device that converts alternating current to direct current.From V-I characteristics of junction diode we see that it allows current only when forward bias.pulsating voltage in one direction will be generated. Which need to be filter by combination of capacitor and resistance. There are two types of rectifier full wave and half wave

Answer the following question based on rectifier

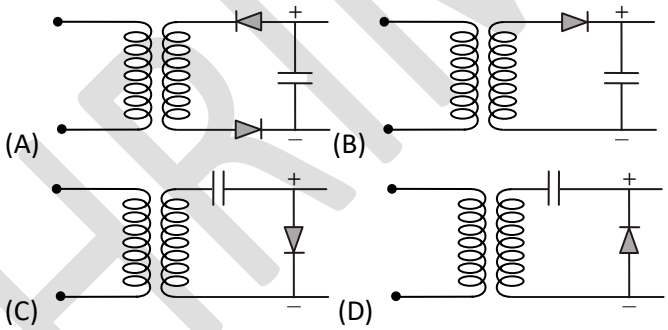
6. In a half wave rectifier, what is frequency of out put if frequency of input is 50 Hz
   (i) 25Hz
   (j) 50 Hz
   (k) zero
   (l) 100Hz
7. In the half-wave rectifier circuit shown. Which one of the following wave forms is true for V_{CD}, the output across C and D?



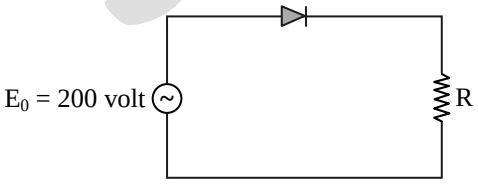


8. Centre tap transformer is used in
   (e) Half wave rectifier
   (f) Full wave rectifier
   (g) Both
   (h) Depends on input frequency

9. Which is the correct diagram of a half-wave rectifier?



5. A sinusoidal voltage of peak value 200 volt is connected to a diode and resistor R in the circuit shown so that half wave rectification occurs. If the forward resistance of the diode is negligible compared to R then rms voltage (in volt) across R is approximately -



(A) 200 (B) 100 (C) $\frac{200}{\sqrt{2}}$ (D) 280