WORK SHEET – 1

Q. 1. The force experienced by a charge q moving with velocity $\vec{v}$ in a magnetic field $\vec{B}$ is $\vec{F} = q(\vec{v} \times \vec{B})$. Which pairs of vectors are always at right angle to each other? 1

Q. 2. What is the amount of work done by a magnetic force on a moving charge and why? 1

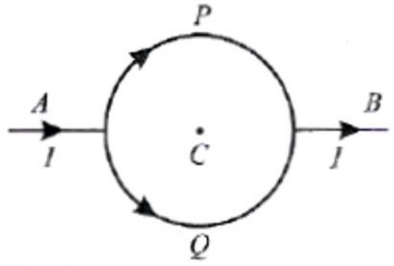
Q. 3. An electron and a proton, having equal momenta, enter a uniform magnetic field at right angle to the field. What will be the ratio of curvature of their trajectories? 1

Q. 4. Two wires of equal length are bent in form of two loops. One is square shape and the other is circular. They are suspended in a uniform magnetic field and the same current is passed through them. Which loop will experience greater torque? 1

Q. 5. Which of the two, an ammeter or a milliammeter, has a higher resistance and why? 1

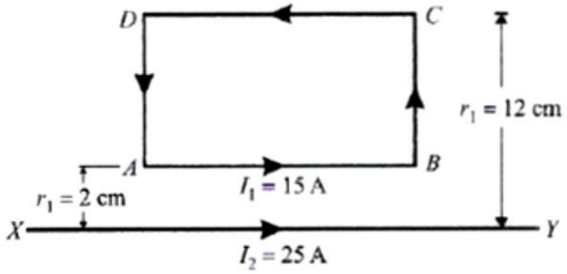
Q. 6. How will the magnetic field intensity at the centre of the circular coil carrying current change, if the current through the coil is doubled and radius of the coil is halved? 2

Q.7. For the current carrying circular loop shown below, what will be the magnetic field at the centre *C*? 2

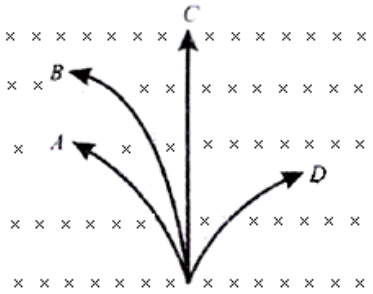


Q.8. A wire carrying a steady current is first bent in form of a circular coil of one turn and then in form of a circular coil of two turns. Fine the ratio of magnetic fields at the centers of the two coils. 2

Q.9. A rectangular loop of sides 25 cm and 10 cm, carrying a current of 15 A, is placed with its longer side parallel to a long straight conductor 2 cm apart carrying a current of 25 A. What is the net force on the loop? 3



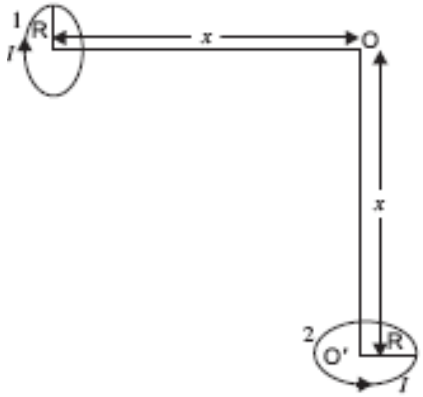
Q. 10. A neutron, a proton, an electron and an alpha particle enter a region of uniform magnetic field with equal velocities. The magnetic field is inward to the plane of paper. The tracks of particles are labeled in the figure. Relate the tracks to the particles. 3



Q. 11. Draw a schematic diagram of a cyclotron. Explain its underlying principle and working, starting clearly the function of the electric and magnetic fields applied on a charged particle. 3

Q.12. (a) Using Biot-Savart's law, derive an expression for the magnetic field at the centre of a circular coil of radius *R*,number of turns *N*, carrying current *I*. 5

(b) Two small identical circular coils marked 1 and 2 carry equal currents and are placed with their geometric axes perpendicular to each other as shown in the figure. Derive an expression for the resultant magnetic field at *O*.



WORK SHEET – 2

Q. 1. A voltmeter and a milli-voltmeter are converted from the same galvanometer. Which one has higher resistance? 1

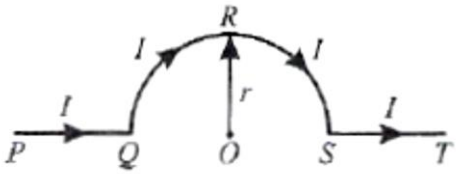
Q. 2. Why do two wires carrying currents in opposite directions repel each other? 1

Q. 3. In the Bohr model of hydrogen atom, an electron revolves around the nucleus in a circular orbit of radius 5.11×10^{-11} m at a frequency of 6.8×10^{15} Hz. What is the magnetic field at the centre of the orbit?1

Q. 4. The wire shown below carries a current *I*. Determine magnetic field at the centre. Radius of circular section is *R*. 1

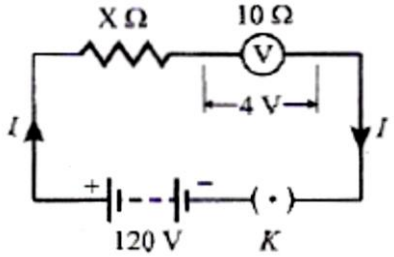
Q. 5. Two long parallel wires carrying currents 8 A and 5 A in the same direction are separated by a distance of 4 cm. Estimate the force on 10 cm length of one wire due to the other wire. 1

Q. 6. A long wire having a semicircular loop of radius *r* carries a current *I*, as shown below. Find the magnetic field due to the entire wire at the point '*O*'. 2



Q. 7. To increase the current sensitivity of a moving coil galvanometer by 50%, its resistance is increased so that the new resistance becomes twice its initial resistance. By what factor does its voltage sensitivity change? 2

Q.8. A source of 120 *V* is connected to a large resistance *X*. A voltmeter of resistance 10 kΩ placed in series reads 4 *V*. What is the value of *X*? Why is voltmeter used instead of an ammeter? 2



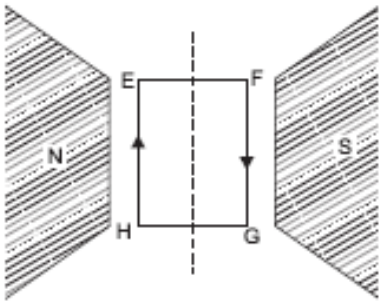
Q.9. A proton and an alpha particle enter at right angles into a uniform magnetic field. Find ratio of radii of their circular paths, when they enter with the (i) same momenta, (ii) same kinetic energy. 3

Q.10. What are permanent magnets ? What is an efficient way of preparing a permanent magnet ? Write two characteristic properties of materials which are required to select them for permanent magnets.

Q.11. Depict the field-line pattern due to a current carrying solenoid of finite length.
(i) In what way do these lines differ from those due to an electric dipole?
(ii) Why can't two magnetic field lines intersect each other? 3

Q.12. (a) Two straight long parallel conductors carry currents *I* 1 and *I* 2 in the same direction. Deduce the expression for the force per unit length between them. Depict the pattern of magnetic field lines around them.
(b) A rectangular current carrying loop *EFGH* is kept in a uniform magnetic field as shown in the fig.

(i) What is the direction of the magnetic moment of the current loop?
(ii) When its the torque acting on the loop (a) maximum, (b) zero? 5



WORK SHEET – 3

1. A vertical wire carries a current in upward direction. In which direction an electron beam sent horizontally towards the wire will be deflected? 1

2. What is the magnetic force on a moving particle along a magnetic field line? 1

3. A moving charge produces (a) electric field only (b) magnetic field only (c) both of them (d) none of them. 1

4. The force experienced by a particle of charge q moving with velocity v in a magnetic field B is given by **F**= q **(VxB).**Which pairs of vectors are always at right angles to each other? 1

5. What is the importance of radial magnetic field in a moving coil galvanometer? 1

6. A proton, a deuteron and an alpha particle having the same kinetic energy are allowed to pass through a uniform magnetic field perpendicular to their direction of motion. Compare the radii of their circular paths. 2

7. Obtain the dimensional formula of permittivity of vacuum in terms of mass, length, time and electric current. 2

8. Why should an ammeter have a low resistance? 2

9. Write down the relation for the force per unit length between two infinitely long parallel straight conductors carrying currents in the same directions. Hence define one ampere. 3

12. The current sensitivity of a moving coil galvanometer is 5 division/mA and voltage sensitivity is 20 division /volt. Find the resistance of the galvanometer. 3

13. How can a moving coil galvanometer be converted into an ammeter? 3

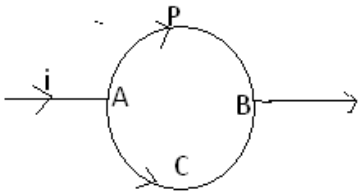
14. With neat diagram write the principle, construction and working of a cyclotron. 5

WORKSHEET - 4

1. State Biot-Savart's law. 1

2. Where is the magnetic field due to current through circular loop uniform ? 1

3. Consider the circuit shown, where APB and ACB are semicircles .What will be the magnetic field at the centre of the circular loop? 1



4. Among alpha, beta and gamma radiations, which get deflected by the magnetic field? 1

5. Two protons P and Q moving with the same speed enter magnetic fields B1 and B2 respectively at right angles to the field directions. If B2 is greater than B1, for which of the protons the circular path in the magnetic field will have a smaller radius? 1

6. Give two factors by which voltage sensitivity of a moving coil galvanometer can be increased? 2

7. Two wires of equal lengths are bent in the form of two loops. One of the loops is square shaped and the other is circular. They are suspended in uniform magnetic field and the same current is passed through them. Which loop will experience greater torque? Give reason. 2

8. A student wants to increase the range of an ammeter from 1mA to 5mA.What should be done to the shunt resistance? 2

9. How can a moving coil galvanometer be converted in to a voltmeter. 3

10. Explain why two wires carrying currents in opposite directions repel each other. 3

11. What is radial magnetic field? Why do we need such a field in a moving coil galvanometer? 3

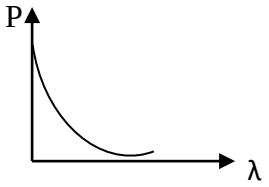
12. Derive an expression for the magnetic field along the axis of an air cored solenoid using ampere's circuital law. Sketch the magnetic field lines for a finite solenoid. 5

Worksheets

UNIT- OPTICS

1. Draw a plot showing the variation of power of a lens with the wavelength of the incident light. (2

Answer: As P α $1/\lambda^2$ (nearly), therefore, the power of a lens decreases with increase of wavelength.



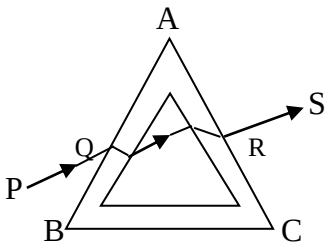
2. Give the reasons for the following: (2

The value of the Brewster angle for a transparent medium is different for lights of different colours.

Answer: Brewster's angle, $i_p = \tan^{-1}(n)$. As refractive index $n \alpha 1/\lambda^2$; is different for lights of different wavelengths (colours), therefore, Brewster's angle is different for lights of different colours.

3. Is dispersion possible in a hollow prism? Also give reason. (2

Answer: No, because both the faces AB and AC of prism behave like glass plates. Any ray of white light (say PQ), after refraction through the faces AB and AC emerges along RS parallel to the incident ray.



4. Why no interference pattern is observed when two coherent sources are (i) infinitely close (ii) far apart from each other. (2

Answer: Fringe width in interference pattern, $\beta = D\,\lambda/d$

(i) When sources are infinitely close, the fringe width will be too large. In such a case even a single fringe may occupy the whole screen; hence no interference pattern is observed.

(ii) When sources are far apart from each other; 'd' will be very large, so fringe width will be too small, the fringes will appear overlapped; hence no interference pattern is observed.

5. Figure shows an experimental set up similar to Young's double slit experiment to observe interference of light. Here SS_2-SS_1=λ/4. Write down the conditions of (i) constructive interference (ii) destructive interference at any point P in terms of path difference (S_2P-S_1P). Does the central fringe observed in the above set up lie above or below 'O'? Give reason. (2

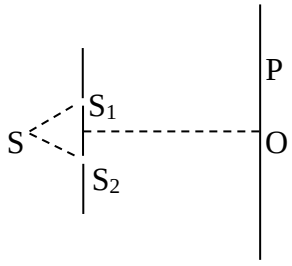
Answer: Here initial path difference, SS_2-SS_1=λ/4.

Therefore, (i) for constructive interference, net path diff.

S_2P-S_1P = (n λ - λ/4) = (n - ¼)λ

& (ii) for destructive interference, net path diff.

S_2P-S_1P = (n + ½) λ - λ/4 = (n + ¼)λ



For central maximum, n = 0

∴ from (i), path difference.= - λ/4

The minus sign shows that central maximum appears below 'O' at a distance = λ/4

6. A ray of light incident on the horizontal surface of a glass slab at 70° just grazes the adjacent vertical surface after refraction. Compute the critical angle and refractive index of glass. (3

Answer: From figure, for total internal reflection at B,

r + C = 90° , r = 90° - C

According to Snell's law

$$n = \frac{\sin i}{\sin r} = \frac{\sin 70°}{\sin(90° - C)} = \frac{\sin 70°}{\cos C}$$

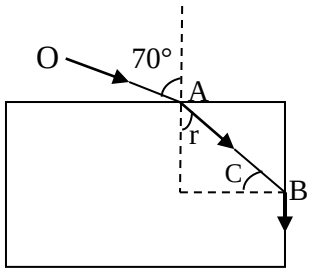
Also, $n = \frac{1}{\sin C}$

$\therefore \quad \frac{\sin 70°}{\cos C} = \frac{1}{\sin C}$ or $\frac{\sin C}{\cos C} = \frac{1}{\sin 70°}$

Or $\tan C = \frac{1}{0.9397} = 1.0642$

Or $C = \tan^{-1}(1.0642) = 46°47'$

Also $n = \frac{1}{\sin C} = \frac{1}{\sin 46°47'} = \frac{1}{0.7288} = 1.372$



7. Sodium light has two wavelengths λ_1=589nm and λ_2=589.6nm. As the path difference increases, when is the visibility of the fringes a minimum? (3

Answer: For visibility of fringes to be minimum, over a path difference x,

$$\frac{x}{\lambda 1} - \frac{x}{\lambda 2} = \frac{1}{2} \textbf{ or } x\{\frac{1}{\lambda 1} - \frac{1}{\lambda 2}\} = \frac{1}{2} \textbf{ or } x\{\frac{\lambda 2 - \lambda 1}{\lambda 1 \lambda 2}\} = \frac{1}{2}$$

$$x = \left\{\frac{\lambda 1 \lambda 2}{2(\lambda 2 - \lambda 1)}\right\} = \frac{589 \times 589.6}{2 \times (589.6 - 589)} nm = 7.2 \times 10^{-5} m$$

8. A convex and a concave mirror each of radius 10cm, are placed facing each other and 15cm apart, as shown in figure. A point object is placed midway between them. Find the position of the final image if the reflection takes place first at the concave mirror and then at the convex mirror. (3

Answer: For the concave mirror

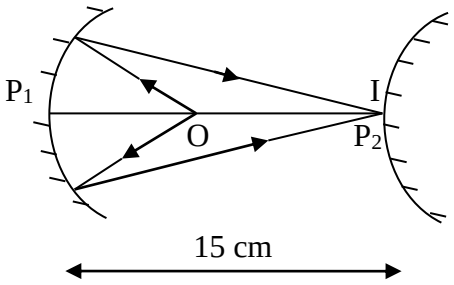
f = -10/2 = -5 cm, u=P_1O= -7.5cm

From mirror formula,

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-5} + \frac{1}{7.5} = -\frac{1}{15}$$

Or v = -15cm, which is P_1I

Thus image of object is formed by concave mirror at the pole of convex mirror. Hence, final image is formed at the pole of convex mirror, just behind P_2.



WORKSHEET – 2

Unit – RAY OPTICS

Class: XII **Max. Marks: 25**

General Instructions:

(i) Answer all the questions.
(ii) Marks for each question are indicated against it.
(iii) Question nos. 1 to 5 are very short answer questions, carrying 1 mark each.
(vi) Question nos. 6 to 8 are short answer questions each carrying 2 marks.
(v) Question nos. 9 to 11 are also short questions each carrying 3 marks.
(vi) Question no. 12 is long answer question carrying 5 marks.

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1. How does the power of a convex lens vary, if the incident red light is replaced by violet light? (1
2. Define critical angle for total internal reflection. (1
3. You are provided with four lenses of focal lengths 1cm, 3cm, 10cm and 100cm. Which two would you prefer for a microscope and which two for a telescope? (1
4. An object is placed at the focus of concave lens. Where will its image be formed? (1
5. A ray of light is normally incident on one face of an equilateral prism. Trace the course of the ray through the prism and emerging from it. (1
6. State the factors on which dispersive power of a prism depends. (2
7. An object is placed at a distance of 36cm from a convex mirror. A plane mirror is placed in between so that the two virtual images so formed coincide. If the plane mirror is at a distance of 24cm from the object, find the radius of curvature of the convex mirror. (2
8. Draw a ray diagram to show the formation of the image of an object by a compound microscope. (2
9. Derive an expression for the magnifying power of the telescope in normal adjustment. (3
10. The far point of a myopic person is 80cm in front of the eye. What is the power of the lens required to enable him to see very distant objects clearly? (3
11. Obtain an expression for the effective focal length of two thin lenses placed in contact coaxially with each other. (3
12. Derive the relation between distance of object, distance of image and radius of curvature of a Convex spherical surface, when refraction takes place from a rater medium of refractive index to a denser medium of refractive index and the image produced is real. State assumptions and convention of signs used. (5

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WORKSHEET – 3
Unit - WAVE OPTICS

Class: XII **Max. Marks: 25**

General Instructions:

(iii) Answer all the questions.
(iv) Marks for each question are indicated against it.
(iii) Question nos. 1 to 5 are very short answer questions, carrying 1 mark each.
(vii) Question nos. 6 to 8 are short answer questions each carrying 2 marks.
(vii) Question nos. 9 to 11 are also short questions each carrying 3 marks.
(viii) Question no. 12 is long answer question carrying 5 marks.

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1. What are coherent sources of light?
   (1
2. Two slits in Young's double slit experiment have widths in the ratio 81:1. What is the ratio of the amplitudes of light waves from them?
   (1
3. How much is the distance in terms of fringe width β between central bright and fourth dark fringe?
   (1
4. Define resolving power of a telescope.
   (1
5. What is the condition for first minimum in case of diffraction due to a single slit?
   (1
6. A polarizer and an analyser are so oriented that intensity of transmitted light is maximum. If the analyser is rotated through 60°, what fraction of the maximum light is transmitted?
   (2
7. Draw a diffraction pattern due to a single slit illuminated by a monochromatic source of light.
   (2
8. Differentiate between polarized and unpolarised lights. How are these represented?
   (2
9. Using Huygens' principle, show that, for a parallel beam incident on a reflecting surface, the angle of reflection is equal to the angle of incidence.
   (3
10. A slit of width'd' is illuminated by red light of wavelength 6500Å. For what value of 'd' will
    i) The first minimum fall at an angle of diffraction of 30° and
    ii) The first maximum fall at an angle of diffraction of 30°.
    (3
11. Define polarizing angle. Derive the relation connecting polarizing angle and the refractive index of a medium.
    (3
12. Derive a mathematical expression for the width of interference fringes obtained in Young's double slit experiment with the help of a suitable diagram.
    (5

VALUE BASED QUESTIONS WITH ANSWERS (UNIT – OPTICS)

1. Shweta's grandmother often complains of headache. Shweta asked her to visit an eye specialist for a check up, but she refused saying that her eye sight is O.K. Some other day, her grandmother asked Shweta to thread a needle. Shweta understood her problem and took her to the eye specialist who prescribed her spectacles of suitable power.

   Read the above passage and answer the following questions:

   a) What could Shweta make out?
   b) Can you guess the nature of lens prescribed?
   c) What values are displayed by Shweta?

   Answer:

   a) Shweta could make out that her grandmother is suffering from hypermetropia have difficulty in viewing nearby objects.
   b) Yes, the eye specialist must have prescribed a convex lens of suitable power.
   c) Shweta has displayed concern for the health of her grandmother in particular and senior citizens in general. Like kids, elderly people must be provided care with love.

2. Mona and Anushka are friends, both studying in class 12. Mona is in Science stream and Anushka is in Arts stream. Both of them go to market to purchase sunglasses. Anushka feels that any coloured glasses with fancy look are good enough. Mona tells her to look for UV protection glasses, Polaroid glasses and photo sensitive glasses.

   Read the above passage and answer the following questions:

   a) What are UV protection glasses, Polaroid glasses and photo sensitive glasses?
   b) What values are displayed by Mona?

   Answer:

   a) UV protection glasses are those which filter ultra-violet rays that are harmful to our eyes. Polaroid glasses help in reducing the glare. Photo-sensitive glasses get darker in strong day light. They protect our eyes from strong sunlight especially at noon.
   b) Mona has displayed concern for her friend. She has put to use the knowledge she acquired in her science classes. Mugging up things for examinations is of no use. What we are taught in class room must be used in practice.

3. The rays of light falling on a convex lens in a direction parallel to principal axis of the lens, get refracted through the lens and meet actually at a single point F on the principal axis of the lens. This point is called principal focus of the lens.

   Read the above passage and answer the following questions:

   a) Is principal focus of a convex lens, a real point? Is the same true for a concave lens?
   b) A distinct image of a distant tree is obtained on a screen held at 40cm from a convex lens. What is its focal length?
   c) Our teachers and parents advise us to stay focused. What does it imply?

   Answer:

   a) Yes, the principal focus of a convex lens is a real point. This is because rays refracted through convex lens meet actually at this point.
   b) F=distance of screen from the lens = 40cm
   c) It implies that we concentrate all out energies/efforts at a single point/problem so that we can resolve the same easily. Staying focused means that we do not divert our energies and attention to several things at a time. This would lead us nowhere. Thus, the secret of success is to stay focussed.

4. The formula governing reflection of light from a spherical mirror is : $\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{2}{R}$.

This is known as mirror formula and is applicable equally to concave mirror and convex mirror. The linear magnification of the mirror is given by $m = \frac{I}{O} = \frac{v}{u}$.

Read the above passage and answer the following questions:

a) An object is held at a distance of 30cm in front of a concave mirror of radius of curvature 40cm. Calculate distance of the image from the object? What is linear magnification of the mirror?

b) The object is moved to a distance of 40cm in front of the mirror. How is focal length of mirror affected?

c) What values of life do you learn from the mirror formula?

Answer:

a) Here, u = - 30cm, R = - 40cm, v = ?

From mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{2}{R}$

$\frac{1}{v} = \frac{2}{R} - \frac{1}{u} = \frac{2}{-40} - \frac{1}{-30} = -\frac{1}{60}$

Or v = - 60cm, on the same side as object.

∴ Distance of image from the object = 60 – 30 = 30cm

Magnification, $m = \frac{I}{O} = \frac{-v}{u} = \frac{+60}{-30} = -2$ (negative sign for inverted image)

b) Focal length (f) of mirror remains unaffected. On changing u; v changes and not f.

c) Mirror formula reveals that f depends only on R, and not on 'u' pr 'v'. In fact on changing 'u', v changes, but' f' remains constant.

In day to day life, 'u' corresponds to a situation that arises and 'v' corresponds to our responses to the situation. We are like a mirror. Our nature/curvature determines our focal length. The mirror formula implies that our nature is not affected by the situation that comes up. Response to a particular situation will depend on our nature.

5. During summer vacation Ravi and Rohit decided to go for a 3-D film (movie). They have heard about this film through their friends. They were asked buy special glasses to view the film. Before they go for a movie, they approached their Physics teacher to know about these glasses. Physics teacher explained when two polarizers are kept perpendicular to each other (crossed polarizers) the left eye sees only the image from the left end of the projector and the right eye sees only the image from the right lens. The two images have the approximate perspectives that the left and right eyes would see in reality the brain combine the images to produce a realistic 3-D effect.

Read the above passage and answer the following questions:

a) What qualities do these boys possess?

b) What do you mean by Polarization?

c) Mention the other applications of polarization.

Answer:

a) Curiosity to learn, approaching the teacher to learn new things, inquisitiveness.

b) The phenomenon of restricting the oscillations of a light wave (electric vector) in a particular direction is called polarization of light.

c) In Sun glasses, Liquid Crystal Displays, CD players etc.