Sample Paper – 2014
Class – XII
Subject –Physics

Questions ON OPTICS

1. What is the focal length of a plane mirror? (Year: 2001)
2. Prove that, for a concave mirror, the radius of curvature is twice the focal length? (1996)
3. Prove the mirror formula for reflection of light from a concave mirror. (1992)
4. Draw a ray diagram to show the formation of image of an object placed between the pole and centre of curvature of a concave mirror. (1995) s
5. Establish the relationship between object distance, image distance and radius of curvature for a concave mirror. (1995, 97) 3
6. Use the mirror formula to show that for an object lying between the pole and focus of a concave mirror, the image formed is always virtual in nature. (1997) 2
7. Will the reflected rays converge at a point when a parallel beam of light is incident on a concave mirror of large aperture? Â · (1994) 1
8. An object is kept in front of a concave mirror of focal length 20 cm. The image formed is three times the size of object. Calculate two possible distances of the object from the mirror. (1994) 3
9. An object 0.05 m high is placed at a distance of 0.5 m from a concave mirror of radius of curvature 0.2 m. Find the position, nature and the size of the image formed. (1994) 3
10. An object is kept in front of a concave mirror of focal length 15 cm. The image formed is three times the size of the object. Calculate the two possible distances of the object from the mirror. (1998) 3
11. Find the position of an object which when placed in front of a concave mirror of focal length 20 cm, produces a virtual image, which is twice the size of the object. (1999) 3
12. A concave mirror is placed in water. Will there be any change in the focal length? Give reason. (2000) 1
13. Establish the relationship between object distance, image distance and radius of curvature for a convex mirror. _ . (1997) 3
14. 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 rarer medium of refractive index ml to a denser medium of refractive index mz and the image produced is real. State assumptions and convention of sign used. - (2003) 5
15. A spherical surface of radius of curvature R, separates a rarer and a denser medium as shown in the figure.

Complete the path of the incident ray of light, showing the formation of a real image. Hence derive
the relation connecting object distance 'uâ€™, image distance â€™vâ€™, radius of curvature R and the

refractive indices nl and nz of the two media.

V. IMP .QUESTIONS BASED UPON OPTICS BY ATS

Q. 1. A telescope has an objective of focal length 50 cm and eyepiece of focal length 5 cm .The least distance of distinct vision is 25cm.The telescope is focused for distinct vision on a scale 200 cm away from the object. Calculate (a) the separation between the objective and eyepiece and (b) the magnification produced. (70.83 cm, -2)

Q. 2. A telescope objective of focal length 1 m forms a real image of the moon 0.92 cm in diameter. Calculate the diameter of the moon taking its mean distance from the earth to be 38x104 km. (3.5 x106 m)

Q. 3. An angular magnification of 30X is desired using an objective of focal length 1.25 cm and an eyepiece of focal length 5 cm. How will you set up the compound microscope? (L=11.67cm.)

Q. 4. A compound microscope is used to enlarge an object kept at a distance of 0.30 m from its objective, which consists of several convex lenses and has focal length 0.02 m. If a lens of focal length 0.1 m is removed from the objective, find out the distance by which the eyepiece of the microscope must be moved to refocus the image? (9cm.)

Q. 5. An amateur astronomer wishes to estimate roughly the size of the sun using his crude telescope consisting of an objective lens of focal length 200 cm and eyepiece of focal length 10 cm. By adjusting the distance of the eyepiece from the objective, he obtains an image of the sun on a screen 40 cm. behind the eyepiece. The diameter of the sun's image is measured to be 6 cm. What is his estimate of the sun's size, given that average earth – sun distance is 1.5x1011 m. (1.5 x 109 m)

Q. 6. A 35 mm slide with a 24 mm x 36 mm picture is projected on a screen placed 12 m from the slide. The image of the slide picture on the screen measures1.0mx1.5 m. Determine the location of the projection lens and its focal length? (28.1cm, 27.5 cm)

Q. 7. An eyepiece of a telescope consists of two plano convex lenses L1 and L2 each of focal length f separated by a distance of $2f/3$. Where should L1 be placed relative to focus of the objective lens of telescope, so that the final image through L2 is seen at infinity? ($f/4$)

Q. 8. A telescope has a objective of diameter 60 cm. The focal lengths of the objective and eyepiece are 2 m and 1.0 cm respectively. The telescope is directed to view two distant point sources of light (e.g. two stars of a binary). The sources are roughly at the same distance (104 light years) along the line of sight, but separated transverse to the line of sight by a distance of 1010 m. Will the telescope resolve the two objects? (Take, λ =6x10-7 m for mean yellow color.) (No)

Q. 9. The separation between the eyepiece (of focal length 0.3 m) and objective (of focal length 0.4 m) of a microscope is 0.2 m. The eyepiece and the objective are to be interchanged such that the angular magnification of the instrument remains the same. What is the new separation between the lenses? Hint: use, m = (0.3m)

Q. 10. The image of the moon is focused by a converging lens of focal length 50 cm on a plane screen. The image is seen by an unaided eye from a distance of 25 cm. Find the angular magnification achieved due to the converging lens? (- 2)

Q. 11. The objective of telescope A has a diameter 3 times that of the objective of telescope B. How much greater amount of light is gathered by A compared to B? Show that range of A is three times the range of B? [Hint: Intensity α] (9 times)

Q. 12. The diameter of sun is several hundred times bigger than the moon, still at the time of solar eclipse, the moon covers the entire sun. How?

Q. 13. How does magnifying power change with change in length of tube of a given telescope and microscope each?

Q. 14. Distinguish between linear magnification and angular magnification. When are these two magnifications equal? 15. When viewing through a compound microscope, our eye should be positioned not on the eyepiece, but a short distance away from it. Why? How much should be that short distance between the eye and the eyepiece?

SUPER -30 OPTICS QUESTIONS FOR BOARDS

Q. 1. Define the following terms

a. Reflection
b. Lens

Q. 2. What is total internal reflection. State the 2 condition necessary for it

Q. 3. Briefly explain (with figure)

a. Mirage formation
b. Working of an optical fiber
   OR
c. Brilliance of diamond
d. Totally reflecting glass prisms

Q. 4. Red light having a wavelength of 700nm in air enters into a medium having a refractive index 2. Find the velocity, frequency and wavelength of light in this medium. How will the color of the light change.

Q. 5. Draw a ray diagram to show the formation of the image of a point object placed in a medium of refractive index n_1 on the principal axis of a convex spherical surface of radius of curvature R and refractive index n_2. Using the diagram derive the formula for the image distance. Also mention the approximations and sign convention used.

Q. 6. A converging lens of focal length 50cm is placed coaxially in contact with another lens of unknown focal length. If the combination behaves like a diverging lens of focal length 50cm, find the power and nature of the second lens

Q. 7. A converging and diverging lens of equal focal lengths are placed coaxially in contact. Find the power and focal length of the combination

Q . 8. A convex lens of power 2.5D produces an image 4 times as large as the object. Find the 2 possible values of the object distance.

Q. 9. Show that a convex lens produces an N times magnified image when the object distance from the lens is (F + F/N) or (F - F/N) where F is the focal length of the lens

Q. 10. (a). Plot a graph to show the variation of the angle of deviation as a function of the angle of incidence for light passing through a prism. Derive the relation for angle of deviation in case of the prism having small apex angle.
OR
Using the above derivation, derive the formula for the refractive index of the prism.

Q. 11. A compound microscope with an objective of focal length 1cm and an eye piece of focal length 2cm has a tube length of 20cm. Calculate the magnifying power of the microscope if the final image is formed at the near point of the eye.

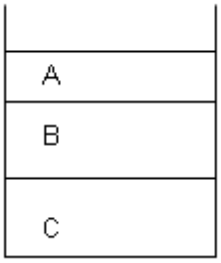
Q. 12. Define refractive index and give its SI unit. What is the range of its values.

Q. 13. Where should an object be placed from a converging lens of focal length 10cm so as to obtain a virtual image of magnification 2

Q. 14. Give Reasons for the following observations

a. Sun is visible even before actual sunrise
b. The sky appears blue
c. The clouds are of white color
d. Sun looks reddish at sunrise and sunset

Q.15. Find the apparent depth of the container as seen from the top. μ_A = 1.5 and its depth is 10cm, μ_B is 2 and its depth is 5cm, μ_c = 1.3 and its depth is 13cm



Q. 16. Briefly explain

a. PRISM FORMULA
b. MAGNIFICATION POWER OF A MICROSCOPE

Q. 17. Red light is incident on a thin converging lens of focal length F. Briefly explain how the focal length of the lens will change if red light is replaced by blue light.

Q. 18. A ray of light passes through an equilateral glass prism such that the angle of incidence is equal to the angle of emergence. If the angle of emergence is 3/4 times the angle of the prism, calculate the refractive index of the prism.

Q. 19. A concave mirror and a concave lens are held separately in water. What changes, if any, do you expect in their focal lengths.

Q. 20. Draw the ray diagram to show the image formation in an astronomical telescope for

a. Normal adjustment
b. Near point adjustment

Derive the expression for magnification in each case.

Q. 21. A ray of light while passing through an equilateral prism undergoes a minimum deviation of 60^o. Find the refractive index of the prism

Q. 22. A converging lens of focal length 20cm is made of refractive index 1.5 .It is immersed in a liquid of refractive index 2. What will be its new focal length. Briefly explain the result

Q. 23. A double concave lens made of glass (1.5) has both radii of curvature equal to 40cm. An object 2cm high is placed 10cm from this lens. Find the position, nature and size of image formed

Q. 24. a. Two lenses of power 15D and -5D are in contact with each other forming a combination lens. Find the power and focal length of the combination

b.>An object of size 3cm is placed at 30cm from this combination. Calculate the size and the position of the image formed

Q. 25. You are given two convex lenses of focal length 4cm and 8cm. Using this show the construction of a compound microscope and with a proper ray diagram derive the expression for magnification produced.

Q. 26. Derive the Lens makers formula and the Lens formula.

Q. 27. A concavo convex lens is made of refractive index 1.5 and R_1 = 20cm. and R_2 = 10cm. Find its focal length.

Q. 28. What is dispersion. Explain its cause. A prism has $\mu R = 1.4$ $\mu_v = 1.5$. Find the angle of dispersion and the dispersive power.

Q. 29. Derive the expression for apparent depth of a swimming pool. Why does refraction of light occur? OR

Explain structure,working and magnification power of a Compound microscope.Draw all necessary diagrams.

Q. 30. Find the critical angle for water-glass interface. What happens if the angle of incidence is lesser than the critical angle.

OR

Explain structure,working and magnification power of a telescope.draw all necessary diagrams.

MODEL Test of Ray and Wave Optics

Section – A

1. Two slits in young's double slit experiment are illuminated by two different sodium lamps emitting light of same wavelength. No interference pattern will be obtained. Comment.
2. What do understand by limit of resolution of instrument?
3. Can sound waves get polarized on passing through the tourmaline crystal?

4. Why white light can not be polarized with polarization by reflection?

5. If a lens is painted with black strips and a donkey is seen through it, the donkey will appear as zebra. Comment.

6. Why the colour of the cloud is white?

7. To a fish under water viewing obliquely a fisher man standing on the bank of a lake, does the man look taller or shorter than what he actually is?

8. A lens of glass is immersed in water. What will be its effect on the power of the lens.

1 x 8 = 8 marks

Section – B

1. How does the frequency of a beam of ultraviolet light change when it goes from air into glass?

2. Derive the relationship between the refractive index and critical angle for a given pair of media.

3. Can we observe interference maxima on the screen if the two slits are separated by less than a wavelength of light used?

4. The ratio of intensity of maxima and minima in an interference pattern is 100:64. Calculate the ratio of intensities of the coherent source producing this pattern.

5. How does the diffraction limit the resolving power of an optical instrument?

6. What is a wavefront? What is the geometrical shape of the wavefront of light emerging out of a convex lens, when a point source is placed at its focus?

7. A ray of light is incident on the surface of a spherical glass paper weight making an angle α with the normal and is refracted in the medium at an angle β. Calculate the deviation.

8. The level of water in a clear colorless glass can be seen easily, but that of liquid helium cannot be. Why?

9. At what angle of incidence should a beam strike the glass slab of refractive index √3, such that the reflected and refracted rays are perpendicular to each other.
10. The sun looks reddish at sunrise and sunset as viewed from earth. Why?

2 x 10 = 20 marks

Section – C

1. The distance between two point sources of light is 24 cm. Find out where you will place a converging lens of focal length 9 cm, if the images of both are formed at the same point.

2. A rectangular block of glass is placed on a printed page lying on a horizontal surface. Find the minimum value of refractive index of glass for which the letters on the page are not visible from any of the vertical faces.

3. Verify Snell's Law of refraction using Huygen's wave theory?

4. What is diffraction of light? Draw a graph showing the variation of intensity with angle in a single slit diffraction experiment. Write one feature which distinguishes the observed pattern from the double slit interference pattern.

5. A region is illuminated by two sources of light. The intensity I at each point is found to be equal to $I_1 + I_2$, where I_1 is the intensity of light at the point when second source is absent. $I_2$is similarly defined. Are the sources coherent or incoherent? Explain.

6. Draw the well labeled dig for the astronomical telescope, when the image formed at the least distance of distinct vision.

7. State and prove Prism Formula.

8. A ray of light falls normally on a refracting face of a prism of refractive index (1.5) . Find the angle of the prism if the ray just fails to emerge from the prism.

9. A diver looks into the external worlds from a depth 'h'. Show by ray diagram that the external world appear to him to be confined within a cone and the whole surface appear as a plane sheet of mirror with a hole above his eye. Calculate the radius of hole.

3 x 9 = 27 marks

Section – D

1. Derive the expression for the Len's maker formula. Hence prove that when white light is incident on the len's you will get many focal lengths.

2. In Young's double slit experiment, deduce the condition for (1) constructive and destructive interference at a point on the screen. Draw the graph showing the variation of intensity versus the position on the screen in Young's experiment when (a) both the slit are open and (b) one of the slit is closed.

3. Which special characteristic of light is demonstrated only by the phenomenon of polarization? Distinguish clearly between linearly polarized light and unpolarised light. Light is incident at the Brewster angle , from air, on to transparent medium. How the refracted and the reflected rays are oriented with respect to each other? Obtain a relation between the refractive index of the medium and the Brewster angle. What is the nature of the polarization of the reflected light, in this case.

5 x 3 = 15

GUESS/Sample Paper – FOR PRACTICE
Class – XII
Subject – Physics

Based on the new pattern for CBSE board examination 2009

Time allowed : 3 hours *Maximum Marks : 70*

General Instructions :

(i) *All questions are compulsory.*
(ii) ***This paper includes questions from chapters one to eight only***
(iii) *Question numbers **1** to **8** are very short answer type questions, carrying **one** mark each.*
(iv) *Question numbers **9** to **18** are short answer type questions , carrying **two** marks each.*
(v) *Question numbers **19** to **27** are also short answer type questions, carrying **three** marks each.*
(vi) *Question numbers **28** to **30** are long answer type questions, carrying **five** marks each.*

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

Q.1> Name two electromagnetic waves that are emitted by an incandescent bulb.

Q.2 > Name the physical quantity whose SI unit is (a) Coulomb per Volt (b) Volt meter

Q.3> A student obtains resistances of 3, 4, 12 and 16 ohms using only two metallic resistance wires either separately or joined together. What is the value of resistance of each of these wires.

Q.4> Mention one advantage and one disadvantage of AC over DC

Q.5> In a certain arrangement a proton does not get deflected while passing through a magnetic field region. Under what conditions is it possible?

Q.6> Lorentz force is given by F = Q (VxB). Of these, name the pairs of vectors which are always at right angles to each other.

Q.7> Mention 2 properties of alloys from which permanent magnets are made

Q.8> An alpha particle and a proton are accelerated by the same potential difference. Calculate the ratio of linear momenta acquired by the two.

Q.9> Define "Intensity of Electric field" at a point. At what points is the electric dipole field intensity parallel to the line joining the charges?

Q.10> Capacitor P, Q and R each have a capacitance C. A battery can charge the capacitor P to a potential V. If after charging P, the battery is disconnected from it and the charged capacitor P is connected in following separate instances to Q and R
(a) In parallel to Q and
(b) In series to R,
Then, what will be the potential difference across P?

Q.11> An inductor of 2mH carries a current of 5A. The direction of current is reversed in it in half a second due to which a voltage is produced across the inductor. What is this phenomenon known as? Find the voltage produced.

Q.12> Why is conductivity of electrolytes less than that of metals?

Q.13> A matrix of N x M cells each of emf E and internal resistance r is connected to an external resistor R. Write an expression for the current flowing in R. Under what condition will this current be maximum.

Q.14> "N" identical cells each of emf E and internal resistance r are connected in series to an external resistor R. Find the internal resistance r in terms of the current I flowing in the circuit.
(c) How does the internal resistance very with temp?

Q.15> A metal wire is stretched to increase its length by 10%. What is the percentage change in its resistance? Will the resistivity of the wire change?

Q.16> Plot a graph to show how the following quantities vary with the frequency of the source. (a) Resistance (b) Capacitive reactance (c) Inductive reactance

Q.17> 2 protons A and B are placed in the space b/w a parallel plate capacitor. "A" is placed closer to the left plate while "B" is placed exactly in the center. Which of them will experience a greater force? Give reasons.

Q.18> An armature coil consists of 20 turns of wire, each of area A = 0.09m² and total resistance 15.0 . It rotates in a magnetic field of 0.5T at a constant frequency of 150/π Hz. Calculate the value of (i) maximum (ii) average induced emf produced in the coil

Q.19> Two point charges Q and 2Q at kept D distance apart. A third charge X is to be kept on the line joining them in such a way that the net force on Q and 2Q is zero. Calculate the position of X in terms of Q and D

Q.20> A 100ohm Resistor and a 200ohm resistor are connected in series across an 84 volt cell. The potential difference across 100ohm is found using a 400ohm Voltmeter. What will be the voltmeter reading. What will be the potential difference across 100ohm if measured with a potentiometer.

Q.21> What are the 3 magnetic elements of Earth.
(b) At a place the vertical and horizontal components of earth's magnetic field are equal to 20G each. What is the net magnetic field and the angle of dip at this place?

Q.22> A wire of uniform cross section and length L has a resistance of 16ohm. It is cut into four equal parts. Each part is stretched uniformly to length L and all the four stretched parts are connected in parallel. Calculate the total resistance of the combination so formed.

Q.23> Write any four characteristics of EM waves. Give 2 uses of (a) Micro waves (b) X rays.

Q.24> State Gauss theorem. Using it derive the Electric field intensity due to a plane sheet of charge.

Q.25> Why is a potentiometer preferred over a voltmeter to measure the emf of a cell? How can a potentiometer be made more sensitive?

Q.26> Derive the force b/w 2 infinite long parallel straight wires carrying current in the same direction. Hence define one ampere.

Q.27> A potential difference V is applied across a conductor of length L and diameter D. How are the electric field and the resistance R of the conductor affected when in turn
(a) V is halved (b) L is halved (c) D is doubled

Q.28> State Biot-Savart Law. Use it to obtain the magnetic field at an axial point distanced z from the center of a circular coil of radius 'a', carrying a current I. Hence compare the magnitudes of the magnetic field of this coil at its center and at an axial point for which z = √3 a.

Q.29> When an inductor L and a resistance R in series are connected across a 12 V , 50Hz ac source, a current of 0.5A flows in the circuit. The current differs in phase from applied voltage by π/3 radian. Calculate the value of R.
(b) A capacitor and a bulb are connected in series to an ac source. Explain, how the brightness of the bulb will change when
(a) Distance b/w the plates of the capacitor is increased
(b) A dielectric slab is introduced in the capacitor

Q.30> A parallel plate capacitor of plate area A and separation d is charged to a potential V. The battery is then disconnected and a dielectric slab of thickness d and dielectric constant K is inserted in the capacitor. What change, if any, will take place in
(a) Charge on the plates
(b) Electric field b/w the plates
(c) Energy stored
(d) Voltage across the capacitor
(e) Capacitance of the capacitor

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