Class: XII Session: 2020- 2021

Subject: Physics

Sample Question Paper (Theory)

Maximum Marks: 70 Marks

Time Allowed: 3 hours

General Instructions:

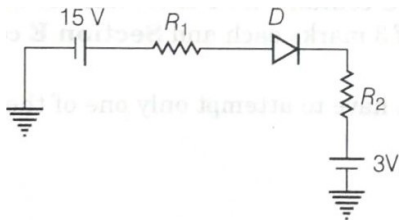
(1) All questions are compulsory. There are 33 questions in all.

(2) This question paper has five sections: Section A, Section B, Section C, Section D and Section E.

(3) Section A contains ten very short answer questions and four assertion reasoning MCQs of 1 mark each, Section B has two case based questions of 4 marks each, Section C contains nine short answer questions of 2 marks each, Section D contains five short answer questions of 3 marks each and Section E contains three long answer questions of 5 marks each.

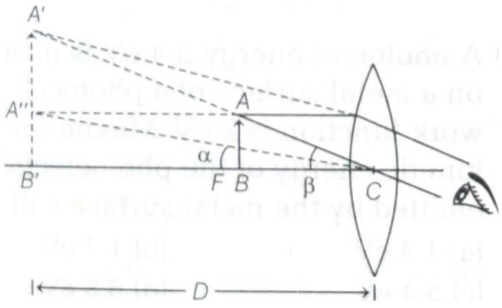
(4) There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

Sr. No	**Section – A** **All questions are compulsory. In case of internal choices, attempt any one of them.**	Marks
1.	Name the Physical quantity whose SI unit is newton/coulomb	1
2.	Name the part of the electromagnetic spectrum of wavelength 10^{-2} m and mention its one application **OR** If the separation between the two slits is decreased in Young's double-slit experiment keeping the screen position fixed. What will	1

	happen to the fringe width?	
3.	A charged particle is moving in a cyclotron, what effect on the radius of path of this charged particle will occur when the frequency of the ratio frequency field is doubled?	1
4.	Define self-inductance of a coil. Write its S.I. unit. OR An alternating current from a source is given by **i**=10sin314t. What is the effective value of current and frequency of source?	1
5.	What is the value of angular momentum of electron in the second orbit of Bohr's model of hydrogen atom?	1
6.	In a photoelectric experiment, the potential required to stop the ejection of electrons from cathode is 4V. What is the value of maximum kinetic energy of emitted Photoelectrons?	1
7.	What is the number of neutrons in a $_{84}$ P0 ^{218} nucleus? OR In decay of free neutron, name the elementary particle emitted along with proton and electron in nuclear reaction.	1
8.	In the following diagram, is the junction diode forward biased or reverse biased?  OR How does the width of a depletion region of a pn - junction vary if doping concentration is increased?	1
9.	What happens in the depletion region of a diode?	1
10.	Why the conductivity of a semiconductor does increases with increase in temperature?	1
	For question numbers 11, 12, 13 and 14, two statements are given-one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions	

	from the codes (a), (b), (c) and (d) as given below. a) **Both A and R are true and R is the correct explanation of A** b) **Both A and R are true but R is NOT the correct explanation of A** c) **A is true but R is false** d) **A is false and R is also false**	
11.	**Assertion(A) :** Net electric field inside a conductor is zero. **Reason(R):** Total positive charge equals to total negative charge in a charged conductor.	1
12.	**Assertion(A) :** Electric field is always normal to equipotential surfaces and along the direction of decreasing order of potential **Reason(R):** Negative gradient of electric potential is electric field.	1
13.	**Assertion(A) :** If objective and eye lenses of a microscope are interchanged, then it can work astelescope. **Reason(R):** The objective lens of telescope has small focal length.	1
14.	**Assertion(A) :** The total reflecting prism is used to erect the inverted image without deviation. **Reason(R):** Rays of light incident parallel to base of prism emerge out as parallel rays.	1
	Section – B **Questions 15 and 16 are Case Study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries 1 mark.**	
15.	**Simple Microscope** Microscope is an optical instrument which forms large image of close and minute objects. A simple microscope is a converging lens of small focal length. When an object is at a distance less	4

than the focal length of the lens, the image obtained is virtual, erect and magnified. When the object is at a distance equal to the focal length of the lens, the image is formed at infinity.



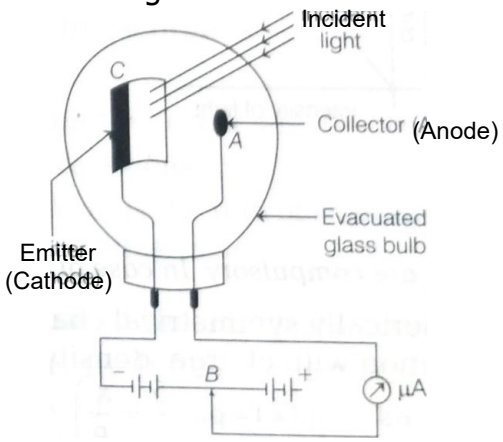
(i) A simple microscope has a limited maximum magnification
(d) greater than 9 (b) lesser than 9
(c) equal to 9 (d) Both (b) and (c)

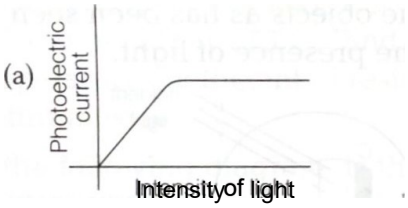
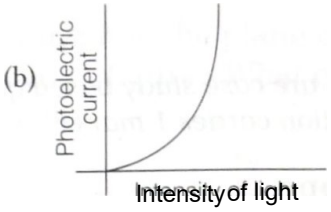
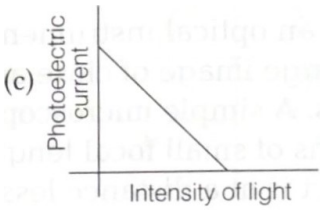
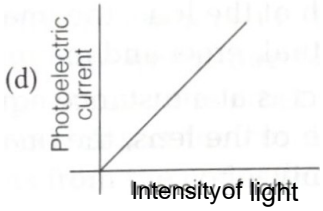
(ii) In order to increase the angular magnification of a simple microscope, one should increase
(a) the object size
(b) the aperture of the lens
(c) the focal length of the lens
(d) the power of the lens

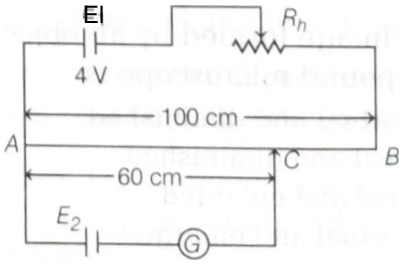
(iii) The image formed by an objective of d compound microscope is
(a) virtual and diminished
(b) real and diminished
(c) real and enlarged
(d) virtual and enlarged

(IV) The distance between the second focal point oi the objective f_o and first focal point of the eyepiece, I.e. f_e is called
(a) tube length
(b) focal length
(c) image distance
(d) radius oi curvature

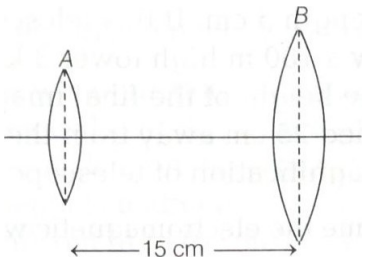
(v) For compound microscope, f_o = 1 cm, f_e = 2.5 cm. An object is placed at distance 1.2 cm from object lens. What should be the length of microscope for normal adjustment?
(a) 8.5 cm (b) 8.3 cm
(c) 6.5 cm (d) 6.3 cm

16.	**Photocell** Photocell is a device which converts light energy into electrical energy. It is also called an electric eye. As, the photoelectric current sets up in the photoelectric cell corresponding to incident light, it provides the information about the objects as has been seen by our eye in the presence of light.  A photocell consists of a semi-cylindncal photosensitive metal plate C (emitter) and d wire loop A (collector) supported in an evacuated glass or quartz bulb. When light of suitable wavelength falls on the emitter C, photoelectrons are emitted. (i) A photocell cannot be used (a) for reproduction ot sound in motion pictures (b) In burglar alarms (c) As a fire alarm (d) to Illuminate room (ii) It Is observed that no electrons are emitted when frequency of light is less than a certain minimum frequency. This minimum frequency depends on (a) potential difference of emitter and collector plates (b) distance between collector and the emitter plate (c) size (area) of the emitter plate (d) material of the emitter plate (iii) The work function of a metal used in photocell is hc/λ_0. If light of wavelength λ is incident on its surface, then the essential conditionfor the electron to come out from the metal surface is (a) $\lambda \geq \lambda_0$ (b) $\lambda \geq 2\lambda_0$ (c) $\lambda \leq \lambda_0$ (d) $\lambda \leq \lambda_0/2$	4

	(iv) Variation of photoelectric current with intensity of light for a photocell is     (v) A photon of energy 3.4 eV is incident on a metal surface of a photocell whose work function is 2 eV. Maximum kinetic energy of the photoelectron emitted by the metal surface will be (a) 1.4 ev (b) 1.7 ev (c) 5.4 ev (d) 6.8 ev	
	Section – C **All questions are compulsory. In case of internal choices, attempt anyone.**	
17.	Why is it that while using a moving coil galvanometer as a voltmeter, a high resistance in series is required? Also draw the circuit diagramfor a voltmeter.	2

18.	Two lenses of power 10D and -5D are placed in contact. (i) Calculate the power of the lens combination. (ii) Where an object should be held from the lens, so as to obtain a virtual image of magnification? OR In a single slit diffraction experiment, the width of the slit is decreased. How will the (a)size (b) an intensity of the central bright band be affected? Justify your answer.	2
19.	A battery E_1 of 4 V and a variable resistance R_h are connected in series with the wire AB of the potentiometer. The length of the wire of the potentiometeris 1m. When a cell of emf 1.5V is connected between the points A and C, no current flows through the galvanometer. Length of AC= 60cm.  (i)Find the potential difference between the ends A and B of the potentiometer. (ii) Would the method work, if the battery E_1 is replaced by a cell of emf of 1V? OR (i) Two wires of equal lengths, one of copper and other of manganin have the same resistance. Which wire will be thicker? (ii) How does the drift velocity of electrons in a metallic conductor vary with the increase in temperature?	2
20.	The current in the forward bias (mA) is known to be more than the current in the reverse bias (μA). What is the reason to operate the photodiode in reverse bias?	2
21.	A coil of wire enclosing an area 100 cm^2 is placed with its plane making an angle 60^0 with the magnetic field of strength 10^{-1}T. What	2

	is the flux through the coil? If magnetic field is reduced to zero in 10^{-3} s, then find the induced emf?	
22.	A small telescope has an objective lens of focal length 150 cm and an eyepiece of focal length 5 cm. If this telescope is used to view a 100 m high tower 3 km away, find the height of the final image, when it is formed 25 cm away from the eyepiece and magnification of telescope is 36.	2
23.	What are extrinsic semiconductors? Write the names and types of dopants.	2
24.	State Bohr's postulate of hydrogen atom that gives the relationship for the frequency of emitted photon in a transition. OR Would the Bohr'sformula for the H- atom remains unchanged, if proton had a charge (+4/3)e, and electron had a charge (-3/4)e, where e= 1.6x 10 $^{-19}$ C. Give reason for your answer.	2
25.	If light of wavelength, λ = 4000 A^0 and intensity 100 W/m ^{2} incident on a metal plate of threshold frequency 5.5 x 10 ^{14}Hz, what will be the maximum kinetic energy, and work function of photoelectron? (Take, h =6.6x10 $^{-34}$ J-s).	2
	Section -D **All questions are compulsory. In case of internal choices, attempt any one.**	
26.	(a)Give one point of difference between nuclear fission and nuclear fusion. (b)Suppose we consider fission of a $^{56}_{26}$Fe into two equal fragments of $^{28}_{13}$Al nucleus. Is the fission energetically possible? Justify your answer by working out Q value of the process. Given $(m)^{56}_{26}$Fe = 55.93494 u and $(m)^{28}_{13}$Al = 27.98191	3
27.	The force experienced by a unit charge when placed at a distance of 0.10 m from the middle of an electric dipole on its axial line is 0.025 N and when it is placed at a distance of 0.2 m, the force is reduced to 0.002 N. Calculate the dipole length. **OR** A charge of 8 mC is located at the origin. Calculate the work done in taking a small charge of -2 x 10 $^{-9}$ C from a point P (0, 0, 3) (in cm)	3

	to a point Q (0, 4, 0) (in cm), via a point R (0, 6, 9) (in cm).	
28.	A metallic rod of length *l* and resistance R is rotated with a frequency v, with one end hinged at the centre and the other end at the circumference Of a circular metallic ring of radius *l*, about an axis passing through the centre and perpendicular to the plane Of the ring. A constant and uniform magnetic field B parallel to the axis is present everywhere. (i)Derive the expression for the induced emf and the current in the rod. (ii)Due to the presence of the current in the rod and of the magnetic field, find the expression for the magnitude and direction of the force acting on this rod **OR** (i) The reactance of a capacitor of capacitance C is X. If both the frequency and capacitance be doubled, then give the expression of the new reactance of circuit. (ii) A wire of resistance R is connected in series with an inductor of reactance ωL then derives the mathematical expression of quality factor of RL circuit.	3
29.	TWO convex lenses A and B of an astronomical telescope having focal lengths 5 cm and 20 cm, respectively are arranged as shown below  (i) Which one of the two lenses you will select as the objective lens and why? (ii) What should be the change in the distance between the lenses to have the telescope in its normal adjustment position? (iii) Calculate the magnitude of magnifying power of the telescope in the normal adjustment position.	3

30.	State the main implications of observations obtained from various photoelectric experiments. Can these implications be explained by wave nature of light? Justify your answer.	3
	Section – E **All questions are compulsory. In case of internal choices, attempt any one.**	
31.	(i) The coil area of a galvanometer is 25 x 10^{-4} $m^{2.}$ It consists of 150 turns of a wire and is in a magnetic field of 0.15 T. The restoring torque constant of the suspension fibre is 10^{-6} N-m per degree. Assuming the magnetic field to be radial, calculate the maximum current that can be measured by the galvanometer, if the scale can accommodate 30^0 deflections. (ii) An electron in H-atom circles around the proton with a speed 3 x 10^6 m/s in an orbit of radius 6 x 10^{-11}m. Calculate (a) the equivalent current and (b) magnetic field produced at the proton. Given, charge on electron is 1.6xIo^{-19}C and μ_0 =4Πx10^{-7} TmA-1. **OR** (i)Write the four imponant properties of the magnetic field lines due to a bar magnet. (ii)Where on the surface of earth is the Vertical component of earth's magnetic field zero? (iii)The horizontal component of the earth's magnetic field at a place is $\sqrt{3}$ times its vertical component there. Find the value of the angle of dip at that place. What is the ratio of the horizontal component to the total magnetic field of the earth at that place?	5
32.	a)Derive the expression for the current flowing in an ideal capacitor and its reactance when connected to an ac source of	5

	voltage V**=V0sinωt.** b) Draw its phasor diagram. c) If resistance is added in series to capacitor what changes will occur in the current flowing in the circuit and phase angle between voltage and current. **OR** Draw a labelled diagram of AC generator, explain its theory and working. An armature coil consists of 20 turns of wire, each ot area, A =0.09 m^2 and total resistance 15 Ω rotates in a magnetic field of 0.5T at a constant frequency (150 /π) Hz. Calculate the value of maximum emf produced in the coil.	
33.	Show that the refractive index of the material of a prism is given by $\mu = \frac{Sin\ (A+\delta m)/2}{Sin(\frac{A}{2})}$ where, symbols have their usual meanings. **OR** (i)When the width of the slit is made double, how would this affect the size and intensity of the central diffraction band? Justify your answer with the help of diagram. (ii)Write three characteristic features to differentiate between diffraction and interference	5

Sample paper (1)
Physics
Class XII

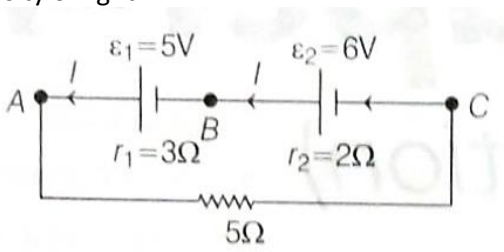
General instructions

1. All questions are compulsory. There are 33 questions in all.
2. This question paper have five sections: **Section A, Section B, Section C, Section D, Section E.**
3. **Section A** contains 10 very short questions and four assertion reasoning MCQs of one mark each,
   Section B has two case based question 4 marks each,
   Section C contains 9 short answer questions of 2 marks each,
   Section D contains 5 short answer questions of 3 marks each and
   Section E contains 3 long answer questions of 5 marks each.
4. There is no overall choice. However internal choice is provided. You have to attempt only one of the choices in such questions.

Section-A

All questions are compulsory. In case of internal choices attempt any one of them.

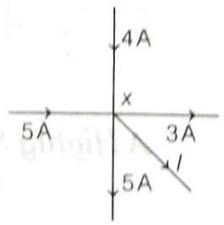
1. If ε_0 and μ_0 are the electric permittivity and magnetic permeability of free space and ε and μ are the corresponding quantities in the medium, then calculate the refractive index of medium in terms of above parameters.
2. Draw the graph showing the variation of photoelectric current with intensity of light.
3. Consider first two cells in series as shown in figure. Find out the potential difference between the terminal A and C of the combination.



4. An electron is moving parallel to the uniform magnetic field 5T with constant velocity 15m/s. Calculate the force acting on the electron.

   OR

   A silver coil of 100 turns, radius $2 \times 10^{-3} m$ carries a current of 1A. Then find out the magnitude of magnetic field at the centre of the coil.
5. Find the ratio of electrostatic force between two point charges of equal charge q (a) in air and (b) in a medium of dielectric constant k.
6. Five conductors are meeting at a point x as shown in figure. What is the value of current in fifth conductor?



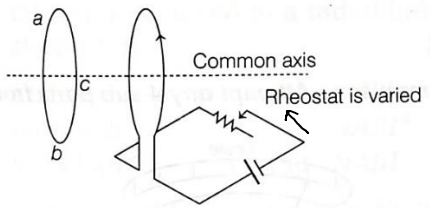
   OR

   A television of 100 watt is used for 2 hours, then what is the value of unit of expense of electricity?
7. How does photo current is produced by solar cell?

   OR

   Find out how the magnetic moment (μ) of an electron revolving around the nucleus varies with principal quantum number.
8. Which electromagnetic radiation has wavelength greater than that of X-rays and smaller than that of visible light?

9. Predict the direction of induced current in the condition described in the figure given below.



10. Why should a nuclear fission precede a nuclear fusion?

OR

The large angle of scattering of Alpha particle in Rutherford experiment is possible only due to nucleus. Give reason.

For question numbers 11, 12, 13 and 14, select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false and R is also false.

11. **Assertion (A)** An electron on p-side of a p-n junction moves to n-side just an instant after diffusion of charge carriers occurs across junction plane.

Reason (R) Drifting of charge carriers reduces the concentration gradient across the junction plane.

12. **Assertion (A)** If we have a point source emitting waves uniformly in all directions, the locus of point which have the same amplitude and vibrate in same phase are spheres.

Reason (R) Each point on the wavefront is the source of a secondary disturbance and the wavelets emanating from these points spread out in all directions with the speed of the wave.

13. **Assertion (A)** Infrared waves are sometimes referred to as heat waves.

Reason (R) Water molecules present in any material readily absorb infrared waves. After absorption, their normal motion increases, i.e. they heat up and heat their surroundings.

14. **Assertion (A)** The property of convergent lens of converging rays remains same in all media.

Reason (R) Property of lens, whether the rays are diverging or converging does not depends on the surrounding medium.

Section-B

Question 15 and 16 are case study based questions and are compulsory. Attempt any 4 sub parts from each question. Each question carries one mark.

15. **Moving coil galvanometer**

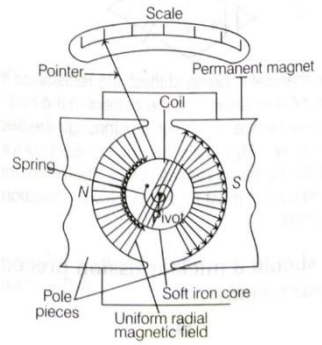
Moving coil galvanometer operates on permanent magnet moving coil (PMMC) mechanism and was designed by the scientist D'arsonval.

Moving coil galvanometer are of two types

(i) Suspended coil

(ii) Pivoted coil type or tangent galvanometer.

Its working is based on the fact that when a current carrying coil is placed in a magnetic field, it experiences a torque. This torque tends to rotate the coil about its axis of suspension in such a way that the magnetic flux passing through the coil is maximum.



(i) A moving coil galvanometer is an instrument which

(a) is used to measure EMF

(b) is used to measure potential difference

(c) is used to measure resistance

(d) is a deflection instrument which gives a deflection when current flows through its coil.

(ii) To make the field radial in a moving coil galvanometer
(a) number of turns of coil is kept small
(b) magnet is taken in the form of horse-shoe
(c) poles are of very strong magnets
(d) poles are cylindrically cut

(iii) The deflection in a moving coil galvanometer is
(a) directly proportional to the torsional constant of spring
(b) directly proportional to the number of turns in the coil
(c) inversely proportional to the area of the coil
(d) inversely proportional to the current in the coil

(iv) In a moving coil galvanometer, having a coil of N-turns of area A and carrying current I is placed in a radial field of strength B. The torque acting on the coil is
(a) NA^2B^2I
(b) $NABI^2$
(c) N^2ABI
(d) $NABI$

(v) To increase the current sensitivity of a moving coil galvanometer, we should decrease
(a) strength of magnet
(b) torsional constant of spring
(c) number of turns in coil
(d) area of coil

16. **Alpha particle scattering experiment**

In this experiment, H. Geiger and E. Marsden took radioactive source ($^{214}_{83}Bi$) for Alpha particles. A collimated beam of Alpha particles of energy 5.5MeV was allowed to fall on $2.1 \times 10^{-7}m$ thick gold foil. The Alpha particles were observed through a rotatable detector consisting of a zinc sulphide screen and microscope and it was found that Alpha particles got scattered. These scattered Alpha particle produced scintillations on the zinc sulphide screen. Observations of this experiment are as follows
(i) Many of the Alpha particles pass through the foil without deflection.
(ii) Only about 0.14% of the incident Alpha particles scattered by more than1^0.
(iii) Only about one Alpha particle in every 8000 Alpha particles deflected by more than 90^0.
Based on these observations, they were able to proposed a nuclear model of atom, are called planetary model, in which entire positive charge and most of the mass of the atom is concentrated in a small volume called the nucleus with electron revolving around the nucleus as planets revolve around the sun.

(i) Rutherford's atomic model can be visualized as

(ii) Gold foil used in Geiger-Marsden experiment is about $10^{-8}m$ thick. This ensures
(a) Gold foil's gravitational pull is small or possible
(b) Gold foil is deflected when Alpha particle stream is not incident centrally over it.
(c) Gold foil provides no resistance to passage of Alpha particle.
(d) Most Alpha particle will not suffer more than 1^0 scattering during passage through gold foil

(iii) In Geiger-Marsden experiment, detection of Alpha particles scattered at a particular angle is done by
(a) Counting flashes produced by Alpha particles on the ZnS coated screen.
(b) Counting spots produced on a photographic film.
(c) Using a galvanometer detector
(d) Using a Geiger-count

(iv) Atoms consists of a positively charged nucleus is obviously from the following observation of Geiger -Marsden experiment

(a) Most of Alpha particles pass straight through the gold foil
(b) Many of Alpha particles are scattered through the acute angles
(c) Very large number of Alpha particles are deflected by larger angles
(d) None of the above

(v) The fact that only a small fraction of the number of incident particles rebound back in Rutherford scattering indicates that
(a) Number of Alpha particles undergoing head-on-collision is small
(b) Mass of the atom is concentrated in a small volume
(c) Mass of the atom is concentrated in a large volume
(d) Both a and b

Section-C

All questions are compulsory. In case of internal choices, attempt any one.

17. How does the mutual inductance of a pair of coil change when,
(i) distance between the coils is increased by 2 times and
(ii) Number of turns in the coils is increased by four times?

OR

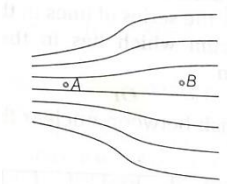
A straight conductor (rod) of length 0.3m is rotated about one end at a constant angular velocity 6280 rad/sec in a plane normal to a uniform magnetic field of induction 5 x $10^{-5}T$.
Calculate the EMF induced between its ends.

18. Draw the energy band diagrams of conductors and insulators.

19. A neutron is absorbed by a ${}^{6}_{3}Li$ nucleus as shown in the reaction below
${}^{6}_{3}Li + {}^{1}_{0}n \longrightarrow {}^{4}_{2}He + {}^{3}_{1}H + Q$
Calculate the energy released in the reaction
Given, $m({}^{6}_{3}Li) = 6.015126\ amu$
$m({}^{4}_{2}He) = 4.0026044\ amu$
$m({}^{1}_{0}n) = 1.0086654\ amu$
$m({}^{3}_{1}H) = 3.016049\ amu$

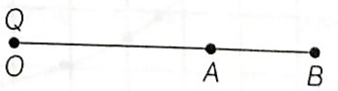
20. Explain the following
(i) Why do magnetic lines form continuous closed loop?
(ii) Which direction would a compass needle point to it located on the geomagnetic North or South Pole?

21. In the electric field shown in figure, the electric field lines on the left have half separation as that between those on the right. If the magnitude of the field at point A is 60NC^{-1}, calculate the force experienced by a proton placed at point B. Also find the magnitude of electric field at point B.



OR

A point charge Q is placed at point O as shown in figure. Is the potential difference $V_A - V_B$ positive, negative or zero, if Q is (i) positive, (ii) negative



22. (i) A current is setup in a long copper pipe. Is there magnetic field (a) inside (b) outside the pipe?
(ii) A charged particle moves through a region of uniform magnetic field. Is the momentum of a particle affected?

23. (i) Draw the graph between total numbers of Alpha particles scattered at different angles.
(ii) Name the series of lines in the hydrogen spectrum which lies in the ultraviolet region.

OR

Distinguish between nuclear fission and fusion.

24. (i) With reference to Photoelectric effect, define threshold wavelength.
(ii) If the energy of photon corresponding to a wavelength of 6000 A^0 is $3.32 \times 10^{-19}J$, then calculate the photon energy of a wavelength of 4000 A^0.

25. (i) Specify the source through which the rays used in radiotherapy are used and write its frequency range.
(ii) The frequency of a radio waves transmitted buy a broadcasting station is 1500 kHz. Determine the wavelength of this wave.

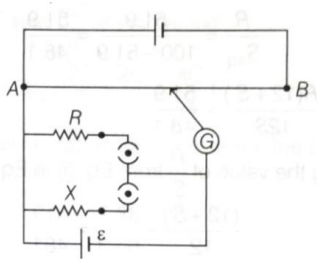
Section-D

All questions are compulsory. In case of internal choices, attempt any one.

26. When two thin lenses of focal length f_1 and f_2 are kept co-axially in contact, prove that their combined focal length f is given by

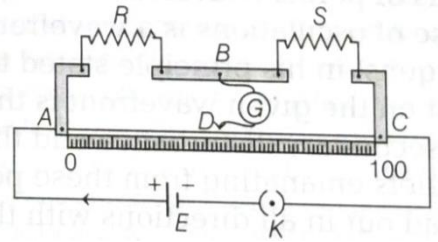
$$\frac{1}{f}=\frac{1}{f_1}+\frac{1}{f_2}$$

27. (i) How does the resistance of a conductor change with temperature?
(ii) Why a potentiometer be preferred over a voltmeter for the measurement of EMF of a cell?
(iii) Figure shows a potentiometer circuit for comparison of two resistances. The balance point with the standard resistor R = 10Ω is found to be 60cm, while that with the unknown resistance X is 70 cm. Determine the value of X.



OR

In a metre Bridge, the null point is found at a distance of 33.7 cm from A. if a resistance of 12Ω is connected in parallel with S, the null point occurs at 51.9 cm. Determine the value of R and S.

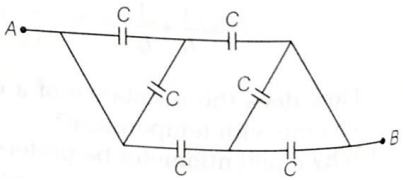


28. Locus of points (wavelets) having same phase of oscillation is a wavefront. Huygens' in his principle stated that each point on the given wavefront is the source of a secondary disturbance and the wavelets emanating from these points spread out in all directions with the speed of wave.
However, when this wavefront transverses through a medium, then velocity get reduced, which can be represented as $v_{medium}=\frac{v_{air}}{n}$, where n is the refractive index of the medium.
Now, using the above knowledge, specify the behavior of a plane wavefront when it is incident on a prism and a spherical mirror and justify your answer.

29. An electric field is uniform in the positive X-direction for positive x and uniform with the same magnitude in the negative X-direction for negative x. It is given that
$\vec{E}=200\,\hat{i}\,NC^{-1}$ for $x>0$
$\vec{E}=-200\,\hat{i}\,NC^{-1}$ for $x<0$
A right circular cylinder of length 20cm and radius 5 cm has its centre at the origin and its axis along the X-axis, so that one face is at x = +10cm while other is at x= -10 cm.
(i) What is the net outward flux through each flat face?
(ii) What is the net outward flux through the cylinder?
(iii) What is the net charge inside the cylinder?

OR

A network of six identical capacitors, each of capacitance C is shown in figure.
Find the equivalent capacitance between point A and B.

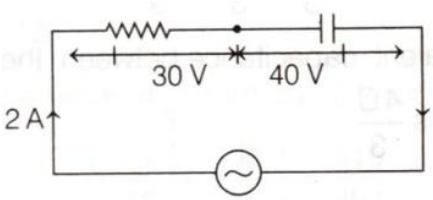


30. Explain the formation of depletion layer and potential barrier in a PN junction with the help of a labelled diagram.

Section-E

All questions are compulsory. In case of internal choices, attempt any one.

31. (i) State the condition for resonance to occur in a series L-C-R AC circuit and derive an expression for the resonant frequency.
Draw the plot showing the variation of peak current I_0 with frequency of the AC source used. Also define the quality factor Q of the circuit
(ii) Calculate the impedance of the given AC circuit



(iii) An ideal inductor is in turn put across (220 volt-50 Hz) and (220 volt-100Hz) supplies. Will the current flowing through it in the two cases be the same or different?

OR

(i) State the principle of working of a transformer. Can a transformer be used to step up or step down a DC voltage?

(ii) Mention the reasons for energy losses in an actual Transformer.

Specify the two characteristic properties of the material suitable for making core of a transformer.

(iii) The power transmission lines need input power at 2300 volt to a step down Transformer with its primary winding having 4000 turns. What should be the number of turns in the secondary winding in order to get output power at 230 V?

32. (i) What is the focal length of a convex lens of focal length 30 cm in contact with a concave lens of focal length 20cm? Is the system a converging or diverging lens? Ignore thickness of the lenses.

(ii) At what angle should a Ray of light be incident on the face of a Prism of refracting angle 60^0 so that it just suffers total internal reflection at the other face? The refractive index of the material of the prism is 1.524

OR

(i) Define the power of lens.

(ii) An angular magnification (magnifying power) of 24 is desired using an objective of focal length 1.25cm and an eyepiece of focal length 5 cm. How will you set up the compound microscope?

33. (i) Deduce the expression for the energy density stored in a charged capacitor.

(ii) Show that the effective capacitance C of a series combination, of three capacitors C_1, C_2 and C_3 is given by

$$C = \frac{C_1 C_2 C_3}{C_1 C_2 + C_2 C_3 + C_3 C_1}$$

OR

Derive an expression for the potential energy of an electric dipole placed in a uniform magnetic field. Hence discuss the condition of stable and unstable equilibrium.