SAMPLE PAPER – I

DESIGN OF THE QUESTION PAPER

PHYSICS - CLASS XII

Time : 3 hours **Maximum Marks : 70**

The weightage of the distribution of marks over different dimensions of the question paper shall be as follows

A. Weightage to content/subject units

Unit.	Marks
Electrostatics	08
Current Electricity	07
Magnetic Effect of Current and Magnetism	08
Electromagnetic Induction and Alternating current	08
Electromagnetic Waves	03
Optics	14
Dual Nature of Radiation and Matter	04
Atoms and Nuclei	06
Electronic Devices	07
Communication Systems	05
Total	**70**

B. Weightage to form of questions

S.No. Form of Questions	Marks for each Question	No. of Questions	Total Marks
1. Long Answer Type (LA)	5	3	15
2. Short Answer SA (I)	3	9	27
3. Short Answer SA (II)	2	10	20
4. Very Short Answer (VSA)	1	8	08
Total		**30**	**70**

C. **Scheme of Options**

1. There will be no overall choice.
2. Internal choices (either/or type) on a very selective basis has been given in five questions. This internal choice is given in any one question of 2 marks, any one question of 3 marks and all three questions of 5 marks weightage.

D. **A weightage of around 15 marks, has been assigned to numericals**

E. **Weightage to difficulty level of questions**

S.No.	Estimated difficulty level	Marks Allotted
1.	Easy	15 %
2.	Average	70 %
3.	Difficult	15 %

PHYSICS BLUE-PRINT- I

	UNIT	VSA (1Mark)	SA I (2 Marks)	SA II (3 Marks)	LA (5 Marks)	TOTAL
1.	Electrostatics	1 (1)	2 (1)	—	5 (1)	8 (3)
2.	Current Electricity	1 (1)	—	6 (2)	—	7 (3)
3.	Magnatic effect of current, and magnetism	1 (1)	2 (1)	—	5 (1)	8 (3)
4.	Electromagnetic induction and Alternating current	—	2(1)	6 (2)	—	8 (3)
5.	EM waves	1 (1)	2 (1)	—	—	3 (2)
6.	Optics	1 (1)	2 (1)	6 (2)	5 (1)	14 (5)
7.	Dual nature of Radiation and Matter	2 (2)	2 (1)	—	—	4 (3)
8.	Atoms and Nuclei	1 (1)	2 (1)	3 (1)	—	6 (3)
9.	Electronic Devices	—	4 (2)	3 (1)	—	7 (3)
10.	Communication systems	—	2 (1)	3 (1)	—	5 (2)
	Total	**8 (8)**	**20 (10)**	**27 (9)**	**15 (3)**	**70 (30)**

SAMPLE PAPER – I
PHYSICS (THEORY)
Class XII

Time: 3hours **M.M.: 70**

General Instructions:

(i) All questions are compulsory.

(ii) There are 30 questions in total. Questions 1 to 8 are very short answer type questions and carry one mark each.

(iii) Questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.

(iv) There is no overall choice. However, an internal choice has been provided in one question of two marks, one question of three marks and all three questions of five marks each. You have to attempt only one of the given choice in such questions.

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

(vi) You may use the following values of physical constants wherever necessary.

$c = 3 \times 10^{8}$ m/s

$h = 6.63 \times 10^{-34}$ Js

$e = 1.6 \times 10^{-19}$ C

$\mu_o = 4\pi x 10^{-7} \text{TmA}^{-1}$

$$\frac{1}{4\pi \in_o} = 9x10^{9} \frac{\text{Nm}^2}{\text{C}^2}$$

1. A ray of light, incident on an equilateral glass prism $\left(\mu_{glass} = \sqrt{3}\right)$ moves parallel to the base of the prism inside it.

   What is the angle of incidence for this ray?

2. A capacitor, of capacitance C, is being charged up by connecting it across a d.c voltage source of voltage V. How do the conduction and displacement currents, in this set up compare with each other

   (a) during the charging up process?

   (b) after the capacitor gets fully charged?

3. Two electrically charged particles, having charges of different magnitude, when placed at a distance 'd' from each other, experience a force of attraction 'F'. These two particles are put in contact and again placed at the same distance from each other.

   What is the nature of force between them now?

4. A resistance R is connected across a cell, of Emf E, and internal resistance r. A potentionter now measures the p.d, between the terminals of the cell, as V. State the expression for 'r' in terms of E, V and R.

5. Show, on a graph, the nature of variation, of the (associated) de-Broglie wavelength (λ_B), with the accelerating potential (V), for an electron initially at rest.

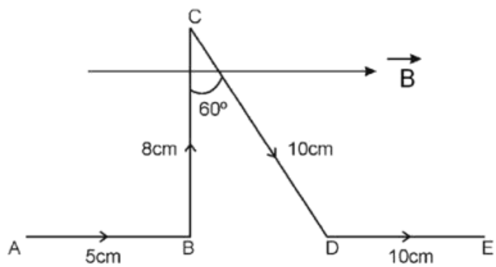
6. The mean life of a radioactive sample is T_m. What is the time in which 50% of this sample would get decayed?

7. A narrow stream, of protons and deuterons, having the same momentum values, enter a region of a uniform magnetic field directed perpendicular to their common direction of motion. What would be the ratio of the radii of the circular paths, described by the protons and deuterons?

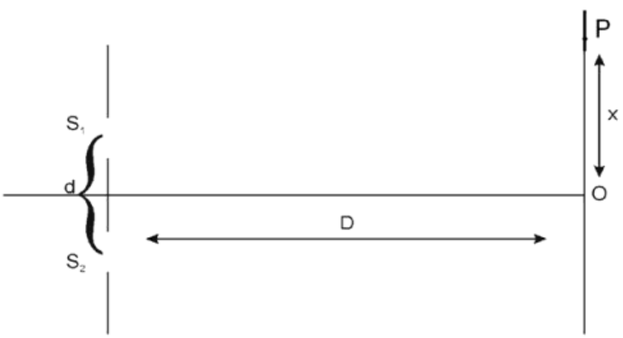
8. A proton, and an alpha particle, both initially at rest, are (suitably) accelerated so as to have the same kinetic energy. What is the ratio of their de - Broglie wavelengths?

9. Find the amount of work done in rotating an electric dipole, of dipole moment 3×10^{-8} Cm, from its position of stable equilibrium, to the position of unstable equilibrium, in a uniform electric field of intensity 10^4 N/C

10. Find the magnitude of the force on each segment of the wire shown below, if a magnetic field of 0.30 T, is applied parallel to AB and DE. Take the value of the current, flowing in the wire, as1 ampere.



11. The intensity, at the central maxima (O) in a Young's double slit set up is I_O. If the distance OP equals one third of the fringe width of the pattern, show that the intensity, at point P., would equal $I_O/4$.



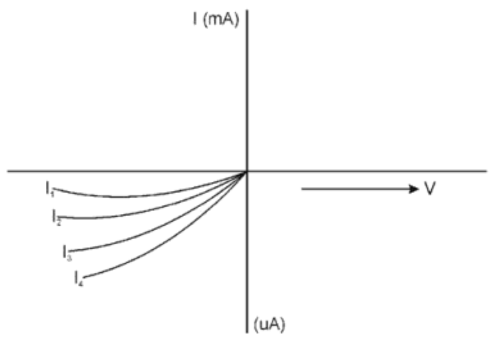
12. An electric heater is connected , turn by turn, to a d.c and a.c sources of equal voltages. Will the rate of heat production be same in the two cases? Explain.

13. Two students A and B prepare the following table about the electromagnetic waves. Rewrite this table in its corrected form.

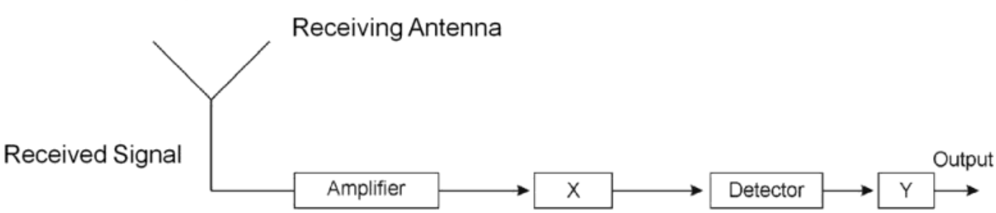
	Direction of			Peak Value of	
Student	Electric field	Magnetic field	Propagation	Electric field	Magnetic field
A	Along X-axis	Along X-axis	Along Y-axis	E	B=cE
B	Along Y-axis	Along Z-axis	Along X-axis	E=cB	B

14. Light, of wavelength 2000 A, falls on a metal surface of work function 4.2 eV. What is the kinetic energy (in eV) of (i) the fastest and (ii) the slowest photo electrons emitted from the surface?

15. Why is a photodiode operated in reverse bias mode? Figure shows reverse bias current, under different illumination intensities I_1, I_2, I_3 and I_4, for a given photodiode. Arrange the intensities I_1, I_2, I_3 and I_4, in decreasing order of magnitude.



16. Block diagram of a receiver is as shown :-



Identify X and Y.

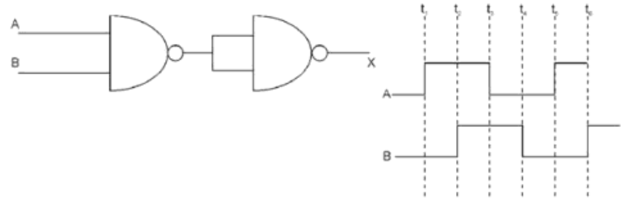
State their function.

17. Name the physical quantity whose S.I Unit is becquerel (Bq): How is this quantity related to (i) disintegration constant, (ii) half life, and (iii) mean life of the radioactive element.

OR

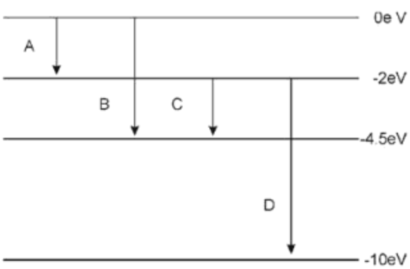
Write the equations for the two types of β-decay. Why is it very difficult to detect the neutrino?

18. Draw the output wave form at X, using the given inputs A,B for the logic circuit shown below. Also identify the (equivalent) gate.



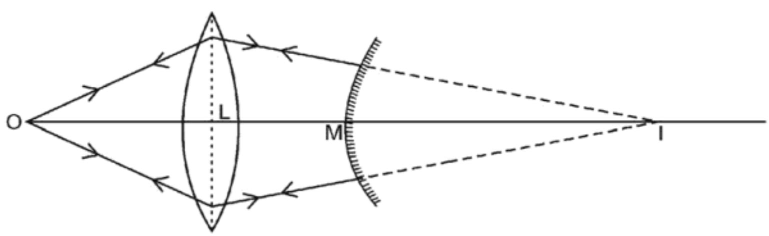
19. A resistor of resistance 400Ω, and a capacitor of reactance 200Ω, are connected in series to a 220V, 50Hz. a.c source. If the current in the circuit is 0.49 ampere find the (i) voltage across the resistor and capacitor (ii) value of inductance required so that voltage and current are in phase.

20. The energy levels of a hypothetical atom are as shown below. Which of the shown transitions will result in the emission of a photon of wavelength 275 nm?

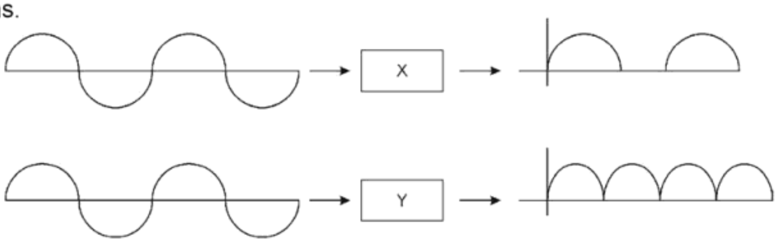


Which of these transition corresponds to emission of radiation of (i) maximum and (ii) minimum wavelength?

21. An object is placed at a distance of 15cm from a convex lens of focal length 10cm. On the other side of the lens, a convex mirror is placed such that its distance, from the lens, equals the focal length of the lens. The image formed by this combination is observed to coincide with the object itself. Find the focal length of the convex mirror.



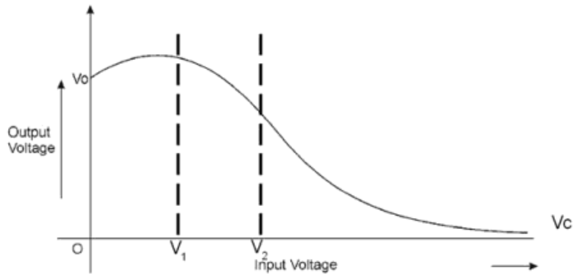
22. An a.c. signal is fed into two circuits X and Y and the corresponding output in the two cases have the waveforms shown below. Name the circuits X and Y. Also draw their detailed circuit diagrams.



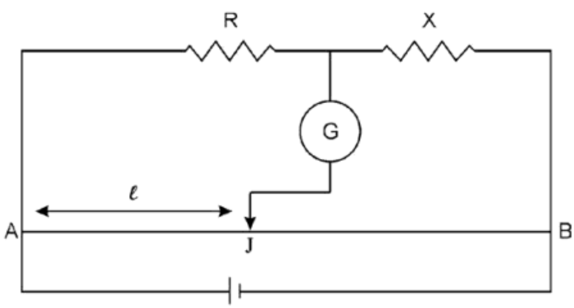
OR

The transfer characteristic of a base - biased transistor in CE configuration is as shown. Name the region corresponding to the values (i) 0 to V_1 (ii) V_1 to V_2 (iii) greater than V_2 of the input voltage applied to the transistor.

Identify the voltage range that should not be used if the transistor has to work as a switch. What is the practical use of transistor, when it is operated in this voltage range? Name the source that results in a higher energy of the output of a transistor operated in this range?



23. In the meter bridge experiment, a student observed a balance point at the point J, where AJ=l. Draw the equivalent Wheat stone Bridge circuit diagram for this set up.



The values of R and X are both doubled and then interchanged. What would be the new position of the balance point? If, in this set up, the galvanometer and battery are interchanged at the balance point position, how will the balance point get affected ?

24. A rectangular loop and a circular loop are moving out of a magnetic field to a field free region with a constant velocity. It is given that the field is normal to the plane of both the loops.

(a) (b)

Draw the expected shape of the graphs, showing the variation of the flux, with time, in both the cases.

What is the cause of the difference in the shape of the two graphs?

25. Two convex lenses, of equal focal length, but of aperture A_1 and A_2 ($A_2<A_1$), are used as the objective lenses in two astronomical telescopes having identical eyepieces.

Compare the ratio of their (i) resolving power (ii) (normal) magnifying power and (iii) intensity of images formed by them. Which one of the two telescopes should be preferred? Why?

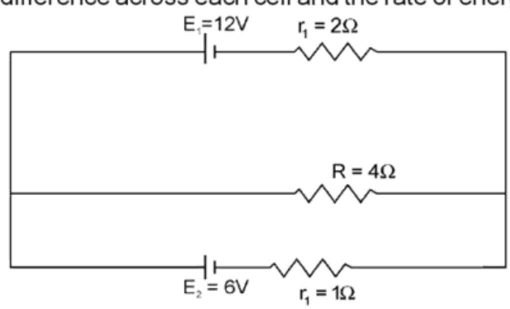
26. Give reasons for the following:-

(i) For ground wave transmission, size of antenna (ℓ) should be comparable to wave-length of signal i.e $\ell \approx \lambda/4$

(ii) Audio Signals, converted into an emwave, are not directly transmitted as such.

(iii) The amplitude of modulating signal is kept less than the amplitude of carrier wave.

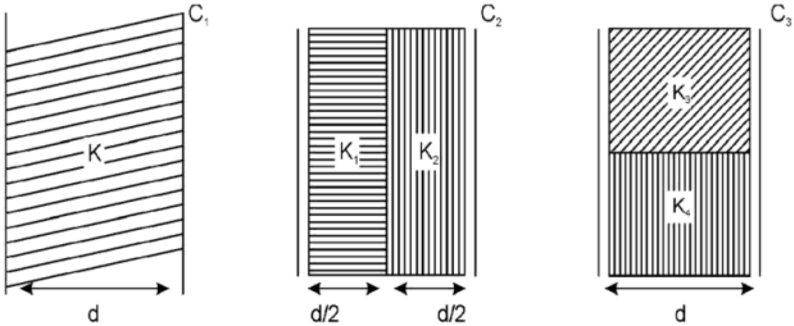
27. Find the potential difference across each cell and the rate of energy dissipation in R



28. State the principle of a machine that can build up high voltages of the order of a few million volts. Also explain the construction and working of this machine.

OR

Three identical parallel plate (air) capacitors C_1, C_2 C_3 have capacitances C each. The space between their plates is now filled with dielectrics as shown. If all the three capacitors, still have equal capacitances, obtain the relation between the dielectric constants K,K_1, K_2, K_3 and K_4.



29. (a) A plane wave front approaches a plane surface separating two media. If medium one is (optically) denser and medium two is (optically) rarer, construct the refracted wave front using Huygens's principle.

Hence prove Snell's law.

(b) Draw the shape of the refracted/reflected wave front when a plane wave front is incident on (i) prism and (ii) convex mirror. Give a brief explanation for the construction.

OR

(a) State the essential condition for the diffraction of light to take place.

A parallel beam of monochromatic light falls normally on a narrow slit and light coming out of the slit is obtained on the screen. Derive an expression for the angular width of the central bright maxima obtained on the screen.

(b) 'Diffraction defines the limit of the ray optics'. Give a brief explanation of this statement.

30. (a) How does a paramagnetic material behave in the presence of an external magnetic field? Explain with the help of an appropriate diagram.

(b) What happens when the temperature of a paramagnetic sample is lowered?

(c) To which of the two - a polar dielectric or a non-polar dielectric - does a paramagnetic material correspond? Justify your answer.

OR

(a) Differentiate clearly between, the geographic and the magnetic meridian. Name and define the 'magnetic element of earth's magnetic field associated with the difference between these two planes. Where does this 'magnetic element' have a higher value - near equator or near the poles?

(b) A magnetic needle, perfectly balanced about a horizontal axis, is free to swing in a plane of the magnetic meridian. In its equilibrium position, the needle makes an angle α with the vertical direction at that place. What is the angle of dip at the place?

What would be the relation between the horizontal component, B_H, and the total magnetic field, B_E, of the earth?

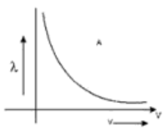
SAMPLE PAPER - I

MARKING SCHEME

(THEORY)

PHYSICS

Class XII

Q. No.	Value point / Expected Answer	Marks	Total
1.	60°	1	1
2.	(a) equal (b) equal	½ + ½	1
3.	repulsive		1
4.	$r = \left(\frac{E}{V} - 1\right)R$	1	1
5.	 8III	1	1
6.	Time needed = Half life = $0.693T_m$	1	1
7.	1:1	1	1
8.	2:1	1	1
9.	$w = pE(1 - \cos\theta)$	½	
	$\theta = 180^{\circ}$	½	
	$W = pE(-(-1))$		
	$= 2pE$		
	$= 2 \times 3.2 \times 10^{-8} \times 10^{4} J$	½	
	$= 6.4 \times 10^{-4} J$		
	= 0.64 mJ	½	2
10.	AB and DE are II to the magnetic field		
	$F = 0 \ (F = IB\ell \sin\theta)$	½ + ½	
	$F_{BC} = I\ell_{BC} B \sin 90^{\circ}$	½	
	= 0.024N		
	$F_{CB} = I\ell_{CD} B \sin 30^{\circ}$	½	2
	= 0.015 N		

11. $x = \frac{1}{3}\beta$(given)

$\Rightarrow x = \frac{\lambda D}{3d}$ ½

$\Delta p = \frac{xd}{D}$

$\Rightarrow \Delta\Phi = \frac{2\pi\Delta p}{\lambda} = \frac{2\pi}{3}$ ½

$I = I_o \cos^2 \frac{\Phi}{2}$ ½

$= I_o \cos^2\left(\frac{2\pi}{3}\right) = I_o/4$ ½ 2

12. The element of the heater is a coil having inductance L and resistance R. Hence, for a. c, its effective resistance (impedance) $\left(=\sqrt{R^2 + (\omega L)^2}\right)$ will be greater than its resistance R for d.c ½ ½

Hence rate of heat production, for the same voltage, for a.c will be less. 1 2

13. Correction for student 'A'

Electric field	Magnetic field	Peak Value of Electric Field	Peak Value of Magnetic Field
Along X-axis or Along Z-axis	Along Z-axis or Along X-axis	E	$B = \frac{E}{c}$

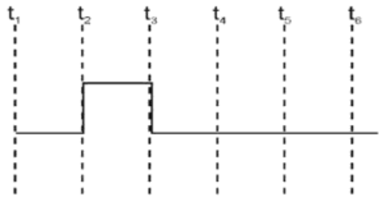
1

No Correction for student B 1 2

14. $E_{photon} = \Phi_o + \frac{1}{2}mV_{max}^2 \rightarrow$ for fastest electron

$\frac{1}{2}mV_{max}^2 = \frac{hc}{\lambda} - \Phi_o$ ½

	$=\left[\dfrac{6.63\text{x}10^{-34}\text{x}3\text{x}10^{8}}{2000\text{x}10^{-10}\text{x}1.6\text{x}10^{-19}}-4.2\right]\text{eV}$	½	
	= 1.99 eV	½	
	The K.E of the slowest emitted electron is zero	½	2
15.	Fractional change, due to the photo effects, on the minority carrier dominated reverse bias current, is more easily measurable than the fractional change in the forward bias current.	1	
	$I_4>I_3>I_2>I_1$	1	2
16.	X = IF Stage	½	
	Y = Amplifier	½	
	IF Stage - Carrier frequency is usually changed to a (standard) lower frequency	½	
	Amplifier - The detected signal may not be strong enough to be made use of and is hence required to be amplified.	½	2
17.	Activity or decay rate	½	
	$R = \lambda N$ | where λ is the decay constant	½	
	$R=\left(\dfrac{0.693}{T_{1/2}}\right)N$ | $T_{1/2}$ is the half life	½	
	$R=\left(\dfrac{1}{T_m}\right)N$ | T_m is the mean life	½	2
	OR		
	β^- decay $\quad {}^{A}_{Z}X \rightarrow {}^{A}_{Z+1}Y + {}^{0}_{-1}e + \bar{\nu}$	½	
	β^+ decay $\quad {}^{A}_{Z}X \rightarrow {}^{A}_{Z-1}Y + {}^{0}_{+1}e + \nu$	½	
	Neutrino is an uncharged particle which interacts very weakly with matter and hence escapes undetected.	1	2

18. 

1   2

AND Gate   1

19. (i) $V_R = I R$

$= 0.49 \times 400V = 196\ V$ ½

$V_C = IX_C$

$= 0.49 \times 200V = 98V$ ½

(ii) V and I are in phase

$$\Rightarrow \omega L = \frac{1}{\omega C}$$

$$\Rightarrow L = \frac{1}{\omega^2 C}$$ 1

$= 0.64H$ 1   3

20. $$E = \frac{hc}{\lambda}$$ ½

$$E = \left[\frac{6.63 X 10^{-34} X 3 X 10^{8}}{275 X 10^{-9} X 1.6 X 10^{-19}}\right] eV = 4.5eV$$ 1

Therefore transition B corresponds to

the emission of a photon of λ=275nm   ½

Transition A emits maximum wavelength   ½

Transition D emits minimum wavelength   ½   3

21. The image, formed by the combination,

coincides with the object itself

This implies that 'I' is the centre

of curvature of the convex mirror   ½

$\Rightarrow$ focal length of mirror

$$f_m = \frac{MI}{2}$$ ½

For lens $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$ ½

u = -15 cm

f = +10 cm ½

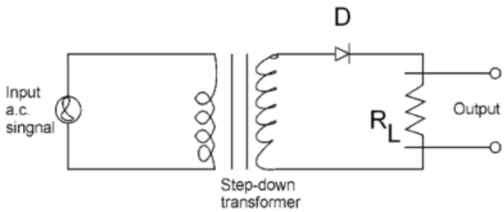
$\Rightarrow$ v = 30cm

$\Rightarrow$ MI = (30-10)cm =20cm ½

$f_m = \frac{MI}{2} = \frac{20}{2} = 10cm$ ½ 3

22. X - Half wave rectifier ½

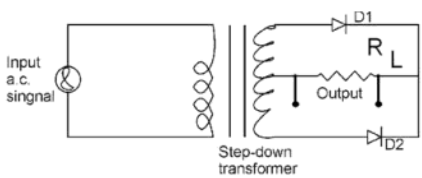
Y - Full wave rectifier ½



1

Circuit diagram of

Half wave rectifier



1

Circuit diagram of

Full wave rectifier 3

OR

(i) O to V_1 Cut off region ½

(ii) V_1 to V_2 Active region ½

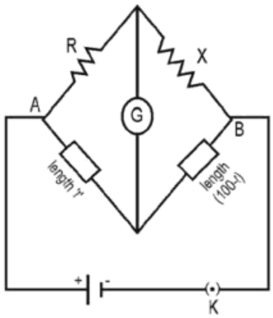
(iii) greater than V_2 Saturation region

For transistor to work as a switch, it should not remain in active region, i.e., from V_1 to V_2 ½

Transistor works as an amplifier in the active region (V_1 to V_2) ½

The energy, for the higher a.c power at
the output is supplied by the biasing battery. 1 3

23.



1

After doubling R and X, and interchanging, let the new balance point be at length ℓ^1. We then have

$$\frac{2X}{2R}=\frac{\ell^1}{\left(100-\ell^1\right)}$$ ½

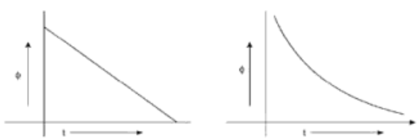
Also $\frac{R}{X}=\frac{\ell}{100-\ell}$ ½

It fellows that

$\ell^1=(100-\ell)$ ½

No there will be no change in the balance point position. ½ 3

24.



1+1

In case of circular loop the rate of change of area during
its passage out of the field, is not a constant 1 3

25. $R.P=\frac{a}{1.22\lambda}\Rightarrow\frac{(R.P)_1}{(R.P)_2}=\frac{A_1}{A_2}$ ½

$M.P=\frac{f_o}{f_e}$(normal adjustment)

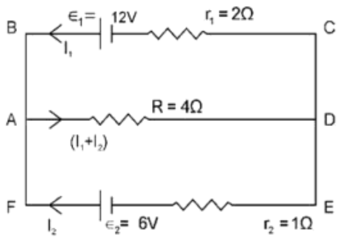
$=1:1$ ½

$$\frac{I_1}{I_2} = \left(\frac{A_1}{A_2}\right) > 1$$ ½

The telescope with objective of aperture A_1 should ½
be prefered for viewing as this would ½
(i) give a better resolution. ½
(ii) have a higher light gathering power of telescope. ½ 3

26. (i) When the size of the antenna is comparable to wave length of the signal the time variation of the signal is properly sensed by the antenna 1
(ii) An e.m. wave, of audio signal frequency, would have a very high wavelength. It would, therefore, need an antenna, whose size would be practically unattainable. 1
(iii) The amplitude of modulating signal is kept less than the amplitude of carrier wave to avoid distortion. 1 3

27. Applying Kirchoff's Laws



For closed loop ABCDA

$$12 = 4(I_1+I_2) + 2I_1$$
$$= 6I_1 + 4I_2 \qquad \text{(i)}$$ ½

For closed loop ADEFA

$$6 = 4(I_1+I_2) + I_2$$
$$= 4I_1 + 5I_2 \qquad \text{(ii)}$$ ½

Solving (i) & (ii)

$$I_1 = \frac{18}{7}\text{A and } \quad I_2 = \frac{-6}{7}\text{A}$$

p.d across R = V= $(I_1+I_2)R$

$$= \left(\frac{18-6}{7}\right) \times 4 \text{ volt} = \frac{48}{7} \text{volt}$$ ½

p.d across each cell = p.d across R ½

Energy dissipated in R = 4Ω

$$=(I_1+I_2)^2 R=\left(\frac{12}{7}\right)^2 \times 4J$$

$$=\frac{576J}{49}=11.75\,J$$ 1

28. The machine is the Van de - Graff generator ½

Principle of Vande graff generator 1½

construction 1

working 2

OR

New Capacitance of $C_1=\frac{k\varepsilon_0 A}{d}$ ½

New Capacitance of C_2

= Series Combination of two Capacitors ½

$$=\frac{\varepsilon_0 A}{d}\left(\frac{2k_1k_2}{k_1+k_2}\right)$$ 1½

New Capacitance of C_3

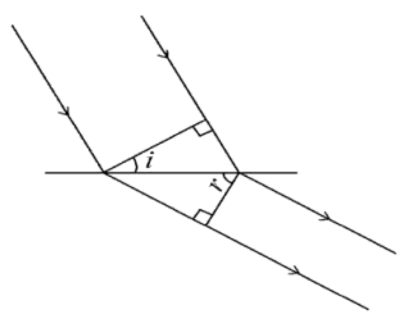
= Parallel Combination of two Capacitors ½

$$\frac{\varepsilon_0 A}{d}\left(\frac{k_3+k_4}{2}\right)$$ 1½

$$\therefore K=\frac{2k_1k_2}{k_1+k_2}$$

$$=\frac{k_3+k_4}{2}$$ ½ 5

29. (a) Construction of refracted wave front



1

$\sin r = \frac{c_1 t}{\text{base}}$ ½

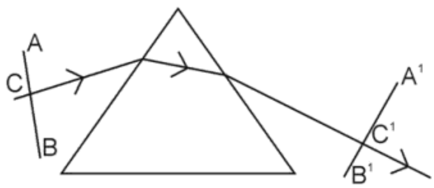
$\sin i = \frac{c_2 t}{\text{base}}$ ½

$\frac{\sin i}{\sin r} = \frac{c_1}{c_2}$ ½

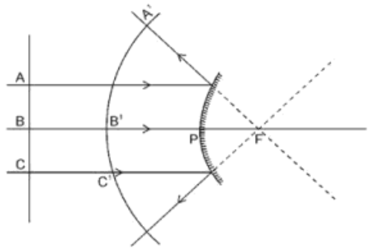
or

${}^{d}_{r}\mu = \frac{c_1}{c_2}$ ½

(b)



½



½

Explanation - time taken by any disturbance to travel from incident wave front to the refracted wave front is same 1

5

OR

Essential Condition for diffraction - size of aperture / obstacle comparable to the wave length of light 1

Derivation of angular width of central maxima = $\left(\frac{\lambda}{a}\right)$ 2

		Explanation of the limit		
		$\lambda \rightarrow o$ for ray optics to be valid	2	5
30.	(a)	Explanation of parallel alignment of atomic dipoles. Net dipole moment non - zero	2½	
	(b)	As the temprature is lowered, the magnetisation increases until it reaches the saturation value at which point all the dipoles are perfectly alinged with the field	1	
	(c)	Paramagnetic material correspond to a polar dielectric.	½	
		This is because the atoms/molecules of such a material have non-zero magnetic moment. A similar statement holds for a polar dielectric where the atoms/molecules of the material, have a non-zero dipole moment.	1	5

OR

(a) Geographic meridian $\rightarrow$ The vertical plane containing the longitude circle and the axis of rotation of the earth 1

Magnetic Meridian $\rightarrow$ The vertical plane passing through the imaginery lines joining the magnetic north and south poles. 1

The magnetic element (associated with the difference between these two planes) is called the 'magnetic declination'. or simply 'declination'. ½

The declination, at a place, equals the angle between the geographic north and the (magnetic) north as shown by a compass needle. 1

The declination has a higher value at higher latitudes -, i.e., near the poles. ½

(b) Angle of dip = $(\pi/2 - \alpha)$ ½

Relation : $B_H = B_E \cos(\pi/2 - \alpha) = B_E \sin\alpha$ ½ 5

SAMPLE PAPER – II

DESIGN OF THE QUESTION PAPER

PHYSICS - CLASS XII

Time : 3 hours **Maximum Marks : 70**

The weightage of the distribution of marks over different dimensions of the question paper shall be as follows

A. Weightage to content/subject units

Unit.	Marks
Electrostatics	08
Current Electricity	07
Magnetic Effect of Current and Magnetism	08
Electromagnetic Induction and Alternating current	08
Electromagnetic Waves	03
Optics	14
Dual Nature of Radiation and matter	04
Atoms and Nuclei	06
Electronic Devices	07
Communication Systems	05
Total	**70**

B. Weightage to form of questions

S.No. Form of Questions	Marks for each Question	No. of Questions	Total Marks
1. Long Answer Type (LA)	5	3	15
2. Short Answer SA (I)	3	9	27
3. Short Answer SA (II)	2	10	20
4. Very Short Answer (VSA)	1	8	8
Total		**30**	**70**

C. Scheme of Options

1. There will be no overall choice.

2. Internal choices (either/or type), on a very selective basis, has been given in five questions. This internal choice is given in any one question of 2 marks, any one question of 3 marks and all three questions of 5 marks weightage.

D. A Weightage, of around15 marks, has been assigned to numericals

E. Weightage to difficulty level of questions.

S.No.	Estimated difficulty level	Marks Allotted
1.	Easy	15 %
2.	Average	70 %
3.	Difficult	15 %

PHYSICS BLUE-PRINT- II

	UNIT	VSA (1 Mark)	SA I (2 Marks)	SA II (3 Marks)	LA (5 Marks)	TOTAL
1.	Electrostatics	1 (1)	2 (1)	—	5 (1)	8 (3)
2.	Current Electricity	1 (1)	—	6 (2)	—	7 (3)
3.	Magnetic effect of current and magnetism	1 (1)	4 (2)	3 (1)	—	8 (4)
4.	Electromagnetic induction and Alternating current	1 (1)	4 (2)	3 (1)	—	8 (4)
5.	Electromagnetic waves	1 (1)	2 (1)	—	—	3 (2)
6.	Optics	1 (1)	2 (1)	6 (2)	5 (1)	14 (5)
7.	Dual Nature of Radiation and Matter	1 (1)	—	3 (1)	—	4 (2)
8.	Atoms and Nuclei	1 (1)	2 (1)	3 (1)	—	6 (3)
9.	Electronic Devices	—	2 (1)	—	5 (1)	7 (2)
10.	Communication system	—	2 (1)	3 (1)	—	5 (2)
	Total	**8 (8)**	**20 (10)**	**27 (9)**	**15 (3)**	**70 (30)**

SAMPLE PAPER – II
PHYSICS (THEORY)
Class XII

Time: 3hours **M.M.: 70**

General Instructions:

(i) All questions are compulsory.

(ii) There are 30 questions in total. Questions 1 to 8 are very short answer type and carry one mark each.

(iii) Questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.

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

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

(vi) You may use the following values of physical constants, wherever necessary.

$c = 3x10^8 m/s$

$h = 6.63 \times 10^{-34} Js$

$e = 1.6x10^{-19} C$

$\mu_\circ = 4\pi x 10^{-7}\, Tm\, A^{-1}$

$$\frac{1}{4\pi\varepsilon_o} = 9x10^9\ \frac{Nm^2}{C^2}$$

1. The velocity of propagation (in vaccum) and the frequency of (i) x rays and (ii) radio waves are denoted by (ϑ_x, n_x) and (ϑ_R, n_R) respectively.

   How do the values of

   (a) ϑ_x and ϑ_R

   (b) n_x and n_R

   compare with each other?

2. How will the intensity of maxima and minima, in the Young's double slit experiment change, if one of the two slits is covered by a transparent paper which transmits only half of the light intensity?

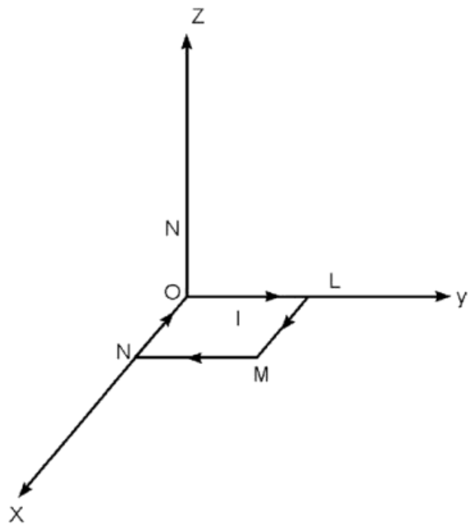
3. The most probable kinetic energy of thermal neutrons at a temperature of T kelvin, may be taken as equal to kT, where k is Boltzmann constant. Taking the mass of a neutron and its associated de-Broglie wavelength as m and λ_B respectively, state the dependence of λ_B on m and T.

4. The short wavelength limits of the Lyman, Paschen and Balmer Series, in the hydrogen spectrum, are denoted by λ_L , λ_P and λ_B respectively. Arrange these wavelengths in increasing order.

5. Charges of magnitudes 2 Q & - Q are located at points (a,o,o) and (4a,o,o). Find the ratio of the flux of electric field, due to these charges, through concentric spheres of radii 2a and 8a centered at the origin.

6. Two identical cells, of negligible internal resistance, are connected in (i) series and (ii) parallel with each other. Find the ratio of currents through a load of resistance R in the two cases?

7.



A given rectangular coil OLMN of area A, carrying a given current I, is placed in a uniform magnetic field $\vec{B} = B\hat{k}$, in the orientation shown here, What is the magnitude of torque experienced by this coil?

8. How does the mutual inductance of a pair of coils change, when (i) distance between the coils is increased (ii) number of turns in each coils is decreased?

9. Name the electromagnetic waves used for the following and arrange them in increasing order of their penetrating power.

(a) Water purification

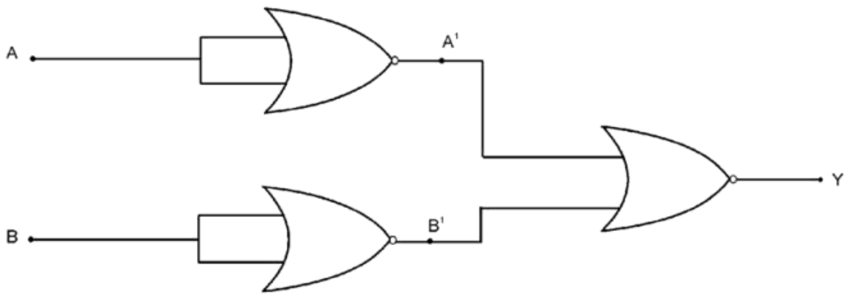
(b) Remote Sensing

(c) Treatment of cancer

10. A light beam is incident on the boundary between two transparent media. At a particular angle of incidence the reflected ray is perpendicular to the refracted ray. Obtain an expression for this angle of incidence. Does this angle depend on the wavelength of light used?

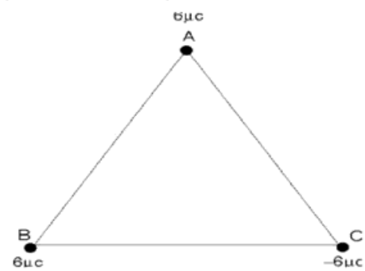
11. Calculate the half life period of a radioactive substance if its activity drops to $\frac{1}{16}$ th of its initial value in 30 years.

12. Inputs A & B are applied to the logic gate set up as shown below. Complete the truth table ,given below, and name the equivalent gate formed by this 'set-up'.



A	B	A'	B'	Y
o	o			
o	1			
1	o			
1	1			

13. Find the amount of work done in arranging the three point charges, on the vertices of an equilateral triangle, ABC, of side 10cm, as shown in the figure.

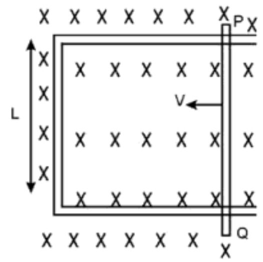


14. Write the relation for current sensitivity and voltage sensitivity of a moving coil galvanometer. Using these relations, explain the fact that increasing the current sensitivity may not necessary increase the voltage sensitivity.

OR

Using the relation for potential energy of a current carrying planar loop, in a uniform magnetic field, obtain the expression for the work done in moving the planar loop from its unstable (equilibrium) position to its stable (equilibrium) position.

15. A straight conductor PQ (Registance = R) is moving in a uniform and time independent magnetic field as shown below. Assuming that there is no loss of energy due to friction, deduce an expression for the power spent by an external agency to move the arm PQ, with a constant speed v, in terms of the magnetic field, the length PQ, R, and speed v.



16. (a) If the magnetic monopoles were to exist, how would the Gauss's law of magnetism get modified?

(b) How will the angle of dip vary when one goes from a place, where the acceleration due to gravity is maximum, to a place where it is minimum, on the surface of earth?

17. A long solenoid, with 20 turns per cm, has a small loop of area $4cm^2$ placed inside the solenoid normal to its axis. If the current carried by the solenoid changes steadily from 4A to 6A in 0.2 second, what is the (average) induced emf in the loop while the current is changing?

18. Draw a plot of the variation of 'amplitude' versus 'ω' for an amplitude modulated wave. Hence explain the need for keeping the broadcast frequencies sufficiently spaced out?

19. In the double slit experiment, the pattern on the screen is actually a superposition of single slit diffraction from each slit and the double slit interference pattern. In what way is the diffraction from each slit related to the interference pattern in a double slit experiment? Explain.

Hence draw the intensity distribution curve, obtained on the screen, in the double slit experiment

(i) when the width of each slit is comparable to wavelength of monochromatic light used
(ii) when the width of each slit is relatively large compared to wave length of monochromatic light.

20. Which two main observations in photoelectricity led Einstein to suggest the photon theory for the interaction of light with the free electrons in a metal? Obtain an expression for the threshold frequency for photoelectric emission in terms of the work function of the metal.

21. Derive the expression for the radius of the n^{th} orbit of hydrogen atom using Bohr's postulates. Show graphically the (nature of) variation of the radius of orbit with the principal quantum number, n.

OR

What is the frequency of radiation emitted when a hydrogen atom de-excites from level x to level (x-1).? For large x, show that this frequency equals the classical frequency of revolution of the electron in the orbit.

22. State various modes of propagation of electromagnetic waves. Explain using a proper diagram, the mode of propagation used in the frequency range from a few MHz upto 40MHz.

23. A 5cm long needle is placed 10cm from a convex mirror of focal length 40cm. Find the position, nature and size of the image of the needle.
What happens to the size of image when the needle is moved farther away from the mirror?

24. Write the nature of path of free electrons in a conductor in the

(i) presence of electric field

(ii) absence of electric field.

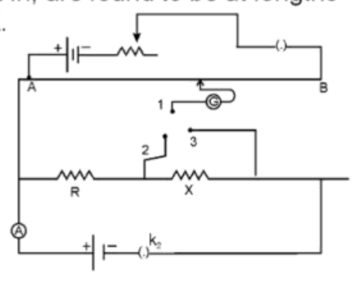
Between two successive collisions each free electron acquires a velocity from o to V where $V=\frac{eE}{m}\tau$. What is the average velocity of a free electron in the presence of an electric field? Do all electrons have the same average velocity?

How does this average velocity of the free electrons, in the presence of an electric field, vary with temperature?

25. A wire AB is carrying a current of 12A and is lying on the table. Another wire CD, carrying a current of 5A, is arranged just above AB at a height of 1mm. What should be the weight, per unit length of this wire so that CD remains suspended at its position? Indicate the direction of current in CD and the nature of force between the two wires.

26. A series LCR circuit is connected to an a-c source of voltage V and angular frequency ω. When only the capacitor is removed, the current lags behind the voltage by a phase angle 'ϕ' and when only the inductor is removed, the current leads the voltage by the same phase angle. Find the current flowing and the average power dissipated in the LCR circuit.

27. A potentiometer circuit is set up as shown. The potential gradient across the potentiometer wire is 0.025 V/cm and the ammeter present in the circuit reads 0.1 A, when the two way key is completely switched off. The balance points, when the key between the terminals (i) 1 & 2 (ii) 1 & 3, is plugged in, are found to be at lengths 40cm and 100cm respectively. Find the values of R and X.



28. Find the expression for the electric field intensity, and the electric potential, due to a dipole at a point on the equiatorial line. Would the electric field be necessarily zero at a point where the electric potential is zero? Give an example to illustrate your answer.

OR

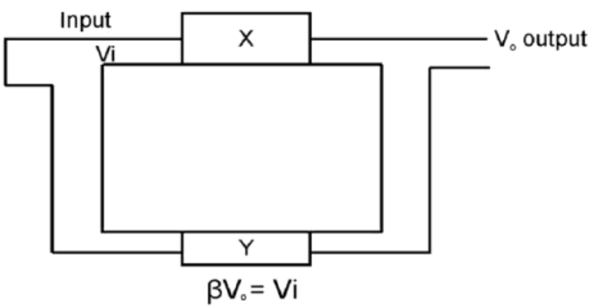
Find the expression for the capacitance of a parallel plate capacitor of area A and plate separation d if (i) a dielectric slab of thickness t, and (ii) a metallic slab of thickness t, where (t<d) are introduced one by one between the plates of the capacitor. In which case would the capacitance be more and why?

29. Draw a ray diagram for a compound microscope. Derive an expression for the magnifying power when the final image is formed at the least distance of distinct vision. State the expression for the magnifying power when the image is formed at infinity. Why is the focal length of the objective lens of a compound microscope kept quite small?

OR

Derive the lens formula giving the relation between u, v and f for a thin convex lens. Define the term 'linear magnification' and draw a graph showing the variation of linear manginification with image distance for a thin convex lens. How can this graph be used for finding the focal length of the lens?

30. The set up, shown below, can produce an a-c output without any external input signal. Identify the components X and Y of this set up. Draw the circuit diagram for this set up and briefly describe its working.



OR

Explain the formation of the depletion region for a P-N Juntion. How does the width of this region change when the junction is

(i) forward biased, and (ii) reverse biased.

(iii) How does an increase in the doping concentration affect the width of the depletion region?

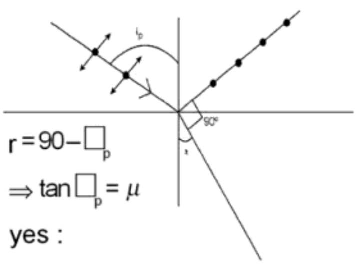
SAMPLE PAPER - II

MARKING SCHEME

(THEORY)

PHYSICS

Class XII

Q No.	Value point / expected points	Marks	Total
1.	(a) equal (b) $n_X > n_R$	½ + ½	1
2.	Intensity of maxima decreases and that of minima increases	½ + ½	1
3.	$\lambda_B \alpha \frac{1}{\sqrt{mT}}$	1	1
4.	$\lambda_L, \lambda_B, \lambda_P$	1	1
5.	2 : 1	1	1
6.	2 : 1	1	1
7.	zero	1	1
8.	(a) decreases (b) decreases	½ + ½	1
9.	(a) U. V radiation	½	
	(b) Microwaves	½	
	(c) γ rays	½	
	In order of penetrating power : γrays>U.V radiation>microwaves	½	2
10.		½	
		½	
	$r = 90 - \square_p$	½	
	$\Rightarrow \tan \square_p = \mu$	½	
	yes :	½	2

11.	$N = \frac{N_o}{16}$ where t = 30 years	½	
	$N = N_o\left(\frac{1}{2}\right)^n$		
	$\frac{N}{No} = \left(\frac{1}{2}\right)^4$	½	
	No. of half lives $n = 4 = \frac{\text{Time of disintegration}}{\text{half life period}}$	½	
	$\Rightarrow \frac{30\text{years}}{4} = \text{half life period}$		2
	$\Rightarrow$ half life period = 7.5 years	½	
12.	A' B' Y		
	1 1 0		
	1 0 0		
	0 1 0		
	0 0 1	1	
	AND Gate	1	2
13.	P.E of a pair of charges :		
	$U = \frac{kq_1q_2}{r}$	½	
	$\because$ Total work done W		
	$= W_1+W_2+W_3$		
	Calculation of W and result	½	
	(in J) W = -3.24 J	1	2
14.	Relation for Current Sensitivity	½	
	Relation for Voltage Sensitivity	½	
	Explantion	1	2
	OR		
	Relation for P.E	½	
	Calculation of work done		
	Work done = -2mB		
	= -2IA B	1½	2

15. $P = Fv$ ½

$= BI\ell v$ ½

$= B\left(\frac{Bv\ell}{R}\right)\ell v$ ½

$= \frac{B^2v^2\ell^2}{R}$ ½ 2

16. (a) $\oint \vec{B}.\vec{ds} = \mu_\circ q_m$ where q_m is the net (magnetic) charge enclosed by the closed surface. 1

(b) from 90° to 0° 1 2

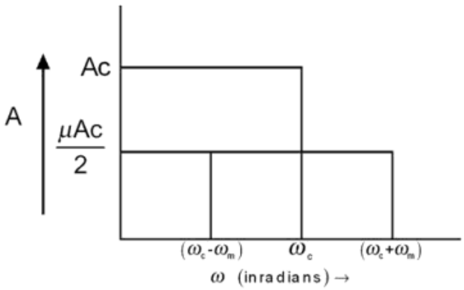
17. $\phi = \vec{B}.\vec{A} = \mu_\circ nIA$ ½

$|E| = \frac{d\phi}{dt} = \frac{d}{dt}(\mu_o nIA) = \mu_\circ nA\frac{dI}{dt}$ ½

Substituting values, we get

$E = 50.24 \times 10^{-5}$ V 1

18. 1



1

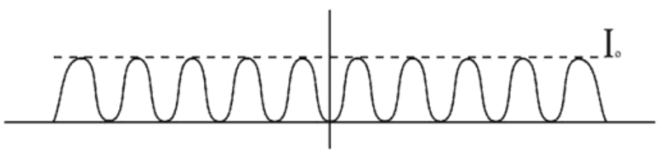
When the broadcast frequencies are spaced out,
the different stations can operate without interference. 1

19. The pattern shows a broader diffraction peak in which there appear several fringes of smaller width due to the double slit interference.

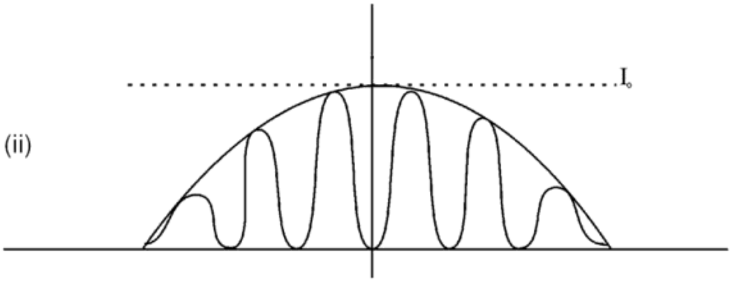
The number of interference fringes depends upon the ratio of the distance between the two slits to the width of a slit.

In the limit of width of a slit becoming very small, the diffraction pattern will become very flat and we will observe the two slit interference pattern. 1

(i)



1

(ii)  1 3

20. Two main observations :-

(i) The maximum kinetic energy of the emitted photoelectrons is independent of the intensity of light. 1

(ii) For each photoemitter, there exist a threshold frequency (of incident light) below which no emission takes place. 1

Relation $h\vartheta = \phi_o + \frac{1}{2} mV^2 \max$

$\Rightarrow h\vartheta_o = \phi_o$ when $V_{max} = O$ 1 3

21. $\frac{mV^2}{r} = \frac{Kq_1q_2}{r^2}$ ½

$L = mVr = \frac{nh}{2\pi}$ ½

$r = \frac{n^2h^2\varepsilon_o}{\pi m Ze^2}$ 1

 1 3

OR

$\vartheta = \frac{me^4}{(4\pi)^3 \varepsilon_o^2}\left[\frac{1}{(x-1)^2} - \frac{1}{x^2}\right]$ ½

$$= \frac{me^4(2x-1)}{(4\pi)^3 \mathcal{E}_o^2 \left(\frac{h}{2\pi}\right) x^2 (x-1)^2}$$ ½

for large x,

$$\upsilon = \frac{me^4}{32\pi^3 \mathcal{E}_o^2 \left(\frac{h}{2\pi}\right)^3 x^3}$$ ½

orbital frequency $\upsilon = \frac{V}{2\pi r}$ ½

where $V = \frac{nh}{2\pi mr}$

and $r = \frac{4\pi\varepsilon_o \left(\frac{h}{2\pi}\right)^2 x^2}{me^2}$ ½

This leads to -

$$\upsilon = \frac{me^4}{32\pi^3 \varepsilon_o^2 \left(\frac{h}{2\pi}\right)^3 x^3}$$ ½ 3

which is same as ϑ for large x

22. (a) Different modes of propagation. 1

(b) mode of propagation used–sky wave propagation

(explanation and diagram). 1+1 3

23. u = -10cm

f = + 40cm ½

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$ ½

v = 8cm ½

$m = \frac{-v}{u} = 0.8 < 1$ ½

When the needle is farther away from the convex mirror, its image moves farther behind the mirror towards the focus and its size goes on decreasing.

When it is far off, it appears almost as a point image at the focus. 1 3

24. (i) Curved path ½

(ii) Straight lines ½

(iii) average velocity $= \frac{eE}{m}\tau$ ½

(iv) No, there is a variation in the velocity for individual electrons. ½

(v) Explanation 1 3

25. As magnetic force is balanced by the weight of wire

$$\frac{W}{\ell} = \frac{F}{\ell} = \frac{\mu_o i_1 i_2}{2\pi r}$$ 1

Substitution and result

$$\frac{W}{\ell} = 12 x 10^{-2} \text{ N/m}$$ 1

Direction of current in CD is opposite to that of in AB ½

Nature of force - repulsive ½ 3

26. $\tan\phi = \frac{X_L - X_C}{R}$

$$\frac{\omega L - \frac{1}{\omega C}}{R}$$

When capacitor is removed

$\tan\phi = \frac{\omega L}{R}$ ½

When inductor is removed

$\tan\phi = \frac{-\frac{1}{\omega C}}{R}$ ½

— ve sign indicates that current leads the voltage

$$\therefore \omega L = \frac{1}{\omega C}$$ ½

$$\omega = \frac{1}{\sqrt{LC}}$$ ½

$\Rightarrow$ LCR circuit is in resonance.

$$i_{rms} = \frac{V_{eff}}{R}$$ ½

Pav = $V_{rms}\ i_{rms}$ ½ 3

V_{rms}^2/R

27.	$R \times 0.1 = k\ell_1$ and $\frac{R}{R+X} = \frac{\ell_1}{\ell_2}$		1	
	Solving we get			
	Value of R =	$10\,\Omega$	1	
	Value of X =	$15\,\Omega$	1	3
28.	Derivation $\vec{E} = \frac{K\vec{P}}{(r^2 + a^2)^{3/2}}$		2½	
	Derivation of V = O		1½	
	No; illustrative example		½ + ½	5
	OR			
	Derivation of Capacitance of parallel plate capacitor			
	(i) with dielectric slab		2	
	(ii) with metal slab		2	
	Reason		1	5
29.	Ray diagram of compound microscope		1	
	Derivation of magnifying power		2	
	Formula of magnifying power for image formed at infinity		1	
	Reason		1	5
	OR			
	Ray diagram of thin convex lens			½

	Derivation of $\frac{1}{f}=\frac{1}{v}-\frac{1}{u}$	2	
	Definition of m	½	
	graph	1	
	Finding focal length from graph	1	5
30.	X - Amplifier circuit	½	
	Y - Feed back circuit	½	
	Circuit Diagram	2	
	Working	2	5
	OR		
	Formation of Depletion layer	2	
	Explanation of each case	2	
	Effect of increase in doping concentration on width of depletion region	1	5

SAMPLE PAPER – III

DESIGN OF THE QUESTION PAPER

PHYSICS - CLASS XII

Time : 3 hours **Maximum Marks : 70**

The weightage of the distribution of marks over different dimensions of the question paper shall be as follows.

A. Weightage to content/subject units

Unit.	Marks
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Current Electricity	07
Magnetic Effect of Current and Magnetism	08
Electromagnetic Induction and Alternating current	08
Electromagnetic Waves	03
Optics	14
Dual Nature of Radiation and Matter	04
Atoms and Nuclei	06
Electronic Devices	07
Communication Systems	05
Total	**70**

B. Weightage to form of questions

S.No. Form of Questions	Marks for each Question	No. of Questions	Total Marks
1. Long Answer Type (LA)	5	3	15
2. Short Answer SA (I)	3	9	27
3. Short Answer SA (II)	2	10	20
4. Very short Answer (VSA)	1	08	08
Total		**30**	**70**

C. Scheme of Options

1. There will be no overall choice.

2. Internal choice (either/or type), on a very selective basis, has been given in five questions. This internal choice is given in any one question of 2 marks, any one question of 3 marks and all three questions of 5 marks weightage.

D. A weightage, of around15 marks, has been assigned to numericals.

E. Weightage to difficulty level of questions

S.No.	Estimated difficulty level	Marks Allotted
1.	Easy	15 %
2.	Average	70 %
3.	Difficult	15 %

PHYSICS BLUE-PRINT- III

	UNIT	VSA (1 Mark)	SA I (2 Marks)	SA II (3 Marks)	LA (5 Marks)	TOTAL
1.	Electrostatics	1 (1)	4 (2)	3 (1)	—	8 (4)
2.	Current Electricity	—	2 (1)	—	5 (1)	7 (2)
3.	Magnetic effect of current and magnetism	1 (1)	4 (2)	3 (1)	—	8 (4)
4.	Electromagnetic induction and Alternating current	1 (1)	2 (1)	—	5 (1)	8 (3)
5.	Electromagnetic waves	1 (1)	2 (1)	—	—	3 (2)
6.	Optics	1 (1)	2 (1)	6 (2)	5 (1)	14 (5)
7.	Dual Nature of Radiation and Matter	1 (1)	—	3 (1)	—	4 (2)
8.	Atoms and Nuclei	—	—	6 (2)	—	6 (2)
9.	Electronic Devices	—	4 (2)	3 (1)	—	7 (3)
10.	Communication system	2 (2)	—	3 (1)	—	5 (3)
	Total	**8 (8)**	**20 (10)**	**27 (9)**	**15 (3)**	**70 (30)**

SAMPLE PAPER – III
PHYSICS (THEORY)
Class XII

Time: 3hours **M.M.: 70**

General Instructions:

(i) All questions are compulsory

(ii) There are 30 questions in total. Questions 1 to 8 are very short answer type and carry one mark each.

(iii) Questions 9 to18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.

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

(v) Use of calculators is not permitted. You may, however, use log tables if necessary.

You may use the following values of physical constants wherever necessary:

$c = 3 \times 10^8 \ ms^{-1}$

$h = 6.63 \times 10^{-34} Js$

$e = 1.6 \times 10^{-19} \ C$

$\mu_o = 4\Pi \times 10^{-7} \ TmA^{-1}$

$$\frac{1}{4\Pi\varepsilon_o} = 9 \times 10^9 \frac{Nm^2}{C^2}$$

1. Let the wavelengths of the electromagnetic waves used quite often for

   (i) killing germs in household water purifiers.

   (ii) remote sensing

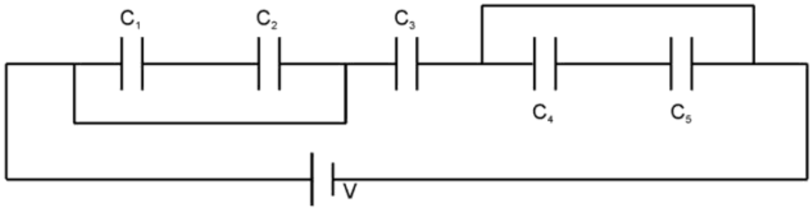
   (iii) treatment of cancer

   be labelled as λ_1, λ_2 and λ_3. Arrange λ_1, λ_2 and λ_3 in increasing order.

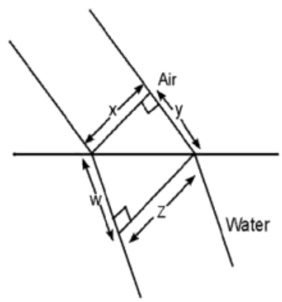
2. The motion of a copper plate is damped when it is allowed to oscillate between the pole pieces of a magnet. State the cause of this damping.

3. Two circular loops, of radii r and 2r, have currents I and I/2 flowing through them in clockwise and anticlockwise sense respectively. If their equivalent magnetic moments are $\overrightarrow{M_1}$ and $\overrightarrow{M_2}$ respectively, state the relation between $\overrightarrow{M_1}$ and $\overrightarrow{M_2}$.

4. What is the equivalent capacitance, C, of the five capacitors, connected as shown ?



5. A plane wave front, of width X, is incident on an air-water interface and the corresponding refracted wavefront has a width Z as shown. Express the refractive index of air with respect to water, in terms of the dimension shown.



6. A device X can convert one form of energy into another. Another device Y can be regarded as a combination of a transmitter and a receiver. Name the devices X and Y.

7. The maximum velocity of electrons, emitted from a metal surface of negligible work function, is 'V' , when frequency of light falling on it is 'f '. What will be the maximum velocity when the incident light frequency is made '4f ' ?

8. An audio signal of frequency υ_a is to be transimitted as an electromagnetic wave

(i) directly as such,

(ii) through its use as the modulating signal on a carrier wave of frequency υ_c.

State the ratio of the size of the transmitting antenna, that can properly sense the time variation of the signal, in terms of υ_a and υ_c.

9. A plane electromagnetic wave, of angular frequency ω, is propagating with velocity c along the Z-axis. Write the vector equations, of oscillating electric and magnetic fields, and show these fields diagramatically .

10. Justify that the electrostatic potential is constant throughout the volume of a charged conductor and has the same value on its surface as inside it.

OR

A capacitor is charged with a battery and then its plate separation is increased without disconnecting the battery. What will be the change in

(a) charge stored in the capacitor?

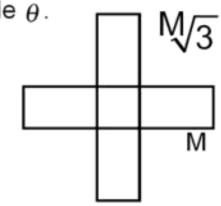
(b) energy stored in the capacitor?

(c) potential difference across the plates of the capacitor ?

(d) electric field between the plates of the capacitor?

11. Draw the current versus potential difference characteristics for a cell. How can the internal resistance of the cell be determined from this graph?

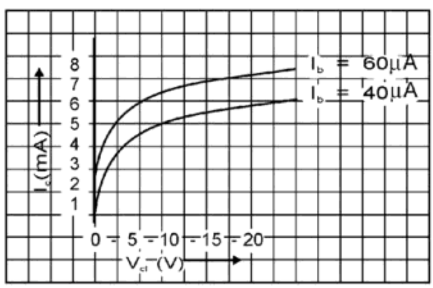
12. Two magnets of magnetic moments M and $M\sqrt{3}$ are joined to form a cross. The combination is suspended in a uniform magnetic field B. The magnetic moment M now makes an angle of θ with the field direction. Find the value of angle θ.



13. A luminiscent object is placed at a depth 'd' in a (optically) denser medium of refractive index 'μ'. Prove that radius r, of the base of the cone of light, from the object, that can emerge out from the surface, is

$$r = \frac{d}{\sqrt{\mu^2 - 1}}$$

14. A certain n - p - n transistor has the common emitter output characteristics as shown



(a) find the emitter current at V_{cc} = 10V and I_b = 60 μA.

(b) find β at this point.

15. Using Gauss law establish that the magnitude of electric field intensity, at a point, due to an infinite plane sheet, with uniform charge density σ is independent of the distance of the field point.

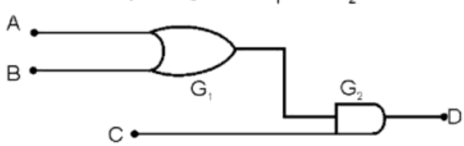
OR

Define an electric field line. Draw the pattern of the field lines around a system of two equal positive charges separated by a distance.

16. An average induced emf of 0.4V appears in a coil when the current in it is changed from 10A in one direction to 10 A in opposite direction in 0.40 second. Find the coefficient of self induction of the coil.

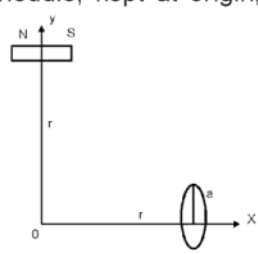
17. A metallic rod of length L, has its two ends hinged respectively, at the center and at the circumference, of a circular metal ring of radius R. The rod is rotated, with a frequency ϑ, about an axis passing through the centre and perpendicular to the plane of the ring . If a constant and uniform magnetic field B, parallel to the axis of rotation is present every where, obtain an expression for the emf between the centre and the circumference of the metallic ring.

18. For the given combination of gates, Find the values of outputs Y_1 and Y_2 in the table given below. Identify the gates G_1 and G_2.

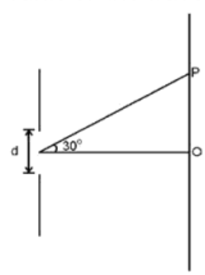


A	B	C	D
0	0	0	Y_1
1	1	0	Y_2

19. A small magnet, of magnetic moment M, is placed at a distance r from the origin O with its axis parallel to x-axis as shown. A small coil, of one turn, is placed on the x-axis, at the same distance from the origin, with the axis of the coil coinciding with x-axis. For what value of current in the coil does a small magnetic neddle, kept at origin, remains undeflected? What is the direction of current in the coil?



20. A slit of width 'd' is illuminated by white light. For what value of 'd' is the first minimum, for red light of λ = 650 nm, located at point P ? For what value of the wave length of light will its first diffraction maxima also fall at P?



21. A charged particle, of charge 2 μ C and mass 10 milligram, moving with a velocity of 1000 ms entres a uniform electric field of strength 10^3 NC^{-1} directed perpendicular to its direction of motion. Find the velocity, and displacement, of the particle after 10s.

22. What reasoning led de- Broglie to put forward the concept of matter waves? The wavelength, λ, of a photon, and the de - Broglie wave length associated with a particle of mass 'm', has the same value, say λ. Show that the energy of photon is $\frac{2\lambda mc}{h}$ times the kinetic energy of the particle.

23. The ground state energy of hydrogen atom is – 13.6 eV.

(i) What are the potential and kinetic energy of an electron in the 3^{rd} excited state?

(ii) If the electron jumps to the ground state from the third excited state, calculate the frequency of photon emitted.

24. Give reason for each of the following observations :

(i) The resultant intensity at any point on the screen varies between zero and four times the intensity, due to one slit, in Young's double slit experiment.

(ii) A few coloured fringes, around a central white region, are observed on the screen, when the source of monochromatic light is replaced by white light in Young's double slit experiment.

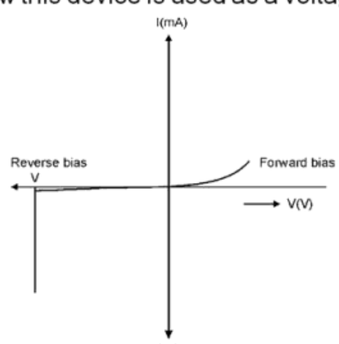
(iii) The intensity of light transmitted by a polaroid is half the intensity of the light incident on it.

25. The figure below shows the V – I characteristics of a semiconductor device.

(i) Identify the semiconductor device used here.

(ii) Draw the circuit diagram to obtain the given charactersitics of this device.

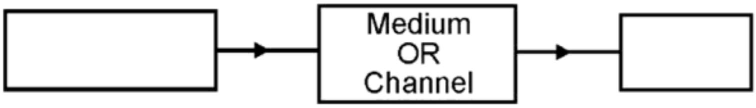
(iii) Briefly explain how this device is used as a voltage regulator.



(b)

26. If nuclei, with lower binding energy per nucleon, transform to nuclei with greater binding energy per nucleon, would the reaction be exothermic or endothermic? Justify your answer and write two examples to support your answer.

27. Complete the following block diagram depicting the essential elements of a basic communication system.



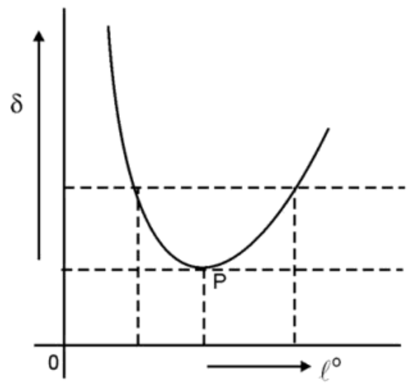
Name the two basic modes of communication. Which of these modes is used for telephonic communication?

OR

Is it necessary for the transmitting antenna and the receiving antenna to be of the same height for line of sight communication? Find an expression for maximum line of sight distance d_m between these two antennas of heights h_T and h_R.

28. A plot, between the angle of deviation (δ) and angle of incidence (i), for a triangular prism is shown below.

Explain why any given value of 'δ' corresponds to two values of angle of incidence? State the significance of point 'P' on the graph. Use this information to derive an expression for refractive index of the material of the prism.

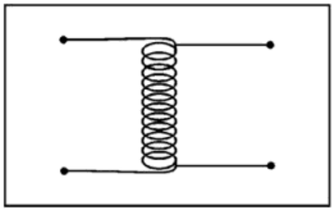


OR

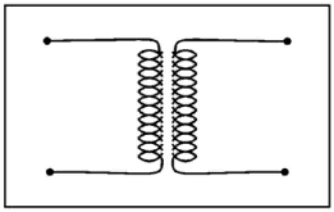
A thin lens, made of a material of refractive index μ, has a focal length 'f'. If the lens is placed in a transparent medium of refractive index 'n' (n<μ), obtain an expression for the change in the focal length of the lens. Use the result to show that the focal length of a lens of the glass ($\mu = \mu_g$) becomes $\frac{\mu_w(\mu_g - 1)}{(\mu_g - \mu_w)}$ times its focal length in air, when it is placed in water ($\mu = \mu_w$).

What happens when n > μ. Explain using appropriate ray diagram.

29. (a) Out of the two arrangements, given below, for winding of primary and secondary coil in a transformer, which arrangement do you think will have higher efficiency and why?



(a)



(b)

(b) Show that, in an ideal transformer, when the voltage is stepped up by a certain factor, the current gets stepped down by the same factor.

(c) State any two causes of energy loss in a transformer.

OR

(a) In a series LCR ac circuit, is the applied instantaneous voltage equal to the algebric sum of the instantaneous voltages across the series elements of the circuit? Is the same true for r.m.s. voltages?

(b) Prove that in a series LCR circuit, the power dissipated depends not only on the voltage and current but also on the cosine of the phase angle ϕ between these two.

30. Is current density a vector or a scalar quantity? Deduce the relation between current density and potential difference across a current carrying conductor of length l, area of cross-section A, and number density of free electrons n. How does the current density, in a conductor vary with

(a) increase in potential gradient?

(b) increase in temperature?

(c) increase in length?

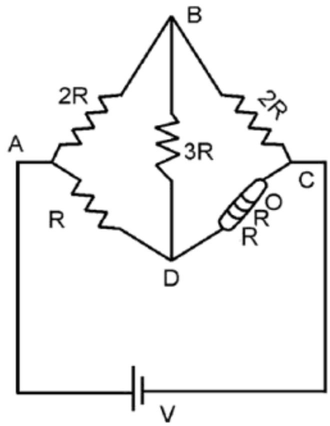
(d) increase in area of cross-section?

(Assume that the other factors remain constant in each case.)

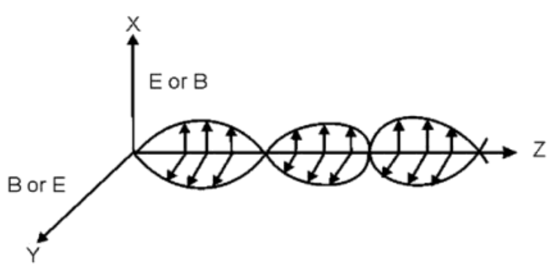
OR

Write the condition of balance in a Wheatstone bridge. In the given Wheatstone bridge, the current in the resistor 3R, is zero. Find the value of R, if the carbon resistor, connected in one arm of the bridge, has the colour sequence of red, red and orange.

The resistances, of BC and CD arms, are now interchanged and another carbon resistance is connected in place of R so that the current through the arm BD is again zero. Write the sequence of colour bands of this carbon resistor. Also find the value of current through it.



SAMPLE PAPER - III
MARKING SCHEME
PHYSICS (THEORY)
Class XII

Q No.	Value point / expected points	Marks	Total
1.	$\lambda_3 < \lambda_1 < \lambda_2$	1	1
2.	eddy currents	1	1
3.	$\vec{M_1} = -\frac{1}{2}\vec{M_2}$	1	1
4.	$C = C_3$	1	1
5.	${}^{a}_{w}\mu = \frac{\sin r}{\sin i} = \frac{w}{y}$	$\frac{1}{2}+\frac{1}{2}$	1
6.	(a) Transducer (b) Repeater	$\frac{1}{2}+\frac{1}{2}$	1
7.	2ϑ	1	1
8.	υ_c / υ_a	1	1
9.	$\vec{E} = E_o \sin\omega t\, \hat{i}$	½	
	$\vec{B} = B_o \sin\omega t\, \hat{j}$	½	
	OR	OR	
	$\vec{E} = E_o \sin \omega t\, \hat{j}$	½	
	$\vec{B} = B_o \sin \omega t\, \hat{i}$	½	
		1	2

10. Since electric field inside the conductor is zero and has no tangential component on the surface, no work is done in moving a small test charge within the conductor or on its surface. 1

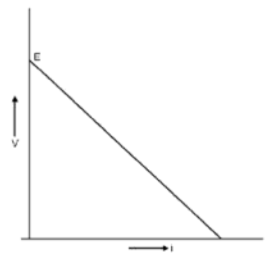
This means that, there is no potential difference between any two points inside or on the surface of the conductor. Hence the potential is constant through out the volume of the conductor and has the same value on its surface. 1 2

OR

(a) decreases (b) decreases ½+½

(c) remains same (d) decreases ½+½ 2

11.



1

Since $V = E - ir$, the internal resistance equals the negative of the slope of this graph 1 2

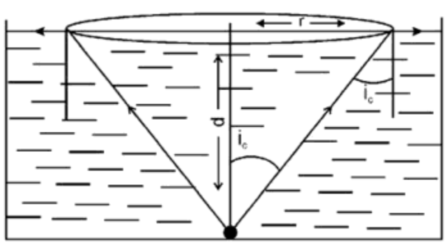
12. $MB \sin\theta = \sqrt{3}\, MB \sin(90° - \theta)$

$= \sqrt{3}\, MB \cos\theta$ 1

$\Rightarrow \tan\theta = \sqrt{3}$

i.e $\theta = 60°$ 1 2

13.



For total internal reflection

$\sin i_c = \frac{1}{\mu}$ ½

also, from the figure,

$\tan i_c = \frac{r}{d}$ ½

$$\therefore \frac{\sin i_c}{\sqrt{1-\sin^2 i_c}} = \frac{r}{d}$$ ½

$$\therefore r = \frac{d}{\sqrt{\mu^2 - 1}}$$ ½ 2

14. (a) For $V_{cc} = 10$ V and $I_b = 60$ μA

$I_c \simeq 6$ mA 1

$I_e = I_c + I_b = 6\text{mA} + 60\,\mu\text{A} = 6.06$ mA

(b) $\beta = \frac{I_c}{I_b} = \frac{6\text{mA}}{60\mu\text{A}} = 100$ 1 2

15. Statement of Gauss law ½

Diagram ½ 2

Derivation 1

OR

Definition of field lines 1

Diagram 1 2

16. $\frac{dI}{dt} = \frac{I_2 - I_1}{at} = \frac{-10-10}{40} = \frac{-20}{40}$ ½

$= -50\ \text{As}^{-1}$ ½

$E = -L\frac{dI}{dt}$ ½

$0.4 = -L\ (-50)$

$L = \frac{0.4}{50}$

$= 0.008\text{H}$ ½ 2

$= 8\text{mH}$

17. dE = magnitude of emf generated across length dr of the

rod = $B\,\vartheta\,dr = B\,(r\omega)\,dr$ ½

$= 2\pi\vartheta Br dr$ ½

Required emf $= \int_0^R dE = 2\pi B\vartheta \int_0^R r\,dr$ ½

$= \pi B \vartheta R^2$ ½ 2

18. $G_1 \rightarrow OR$ $G_2 \rightarrow AND$ $\frac{1}{2}+\frac{1}{2}$ 2

$Y_1 = O$ $Y_2 = O$ 1

19. This happens when magnetic field of bar magnet is equal and opposite

to the magnetic field of coil $\Rightarrow \left|\overrightarrow{B_M}\right| = \left|\overrightarrow{B_C}\right|$ 1

$$\frac{\mu_o M}{4\pi r^3} = \frac{\mu_o I a^2}{2r^3}$$ 1

$$\Rightarrow I = \frac{2M}{4\pi\, a^2}$$ ½ 3

Current is in anticlockwise sense, as seen from the origin. ½

20. At first minimum n=1

$d \sin 30^o = n\,\lambda$ ½

or $\frac{d}{2} = 1 \times 650$ nm

or $d = 1300$ nm 1

For 1st maxima to lie at P:

$$d \sin\theta = \frac{3}{2}\lambda^1$$ ½

or $\lambda^1 = \frac{2d\sin\theta}{3} = \frac{2 \times 1300 \times \sin 30^o}{3}$ nm

$=$ 433.3 nm 1 3

21. The velocity of the particle, normal to the direction of field,

$\vartheta_x = 1000 ms^{-1}$, is constant. ½

The velocity of the particle, along the direction of field,
after 10s, is given by

$\vartheta_y = u_y + a_y$

$= 0 + \frac{qE_y}{m}t$

$= \frac{2x10^{-6}x10^{3}x10}{10x10^{-6}} = 2000ms^{-1}$ ½

The net velocity after 10s

$\vartheta = \sqrt{\vartheta_x^2 + \vartheta_y^2}$

$= \sqrt{(1000)^2 + (2000)^2}\ ms^{-1}$

$= 1000\sqrt{5}\ m\ s^{-1}$ ½

Displacement, along the x-axis, after 10s

X=1000 x 10m = 10000 m

Displacement along y - axis (in the direction of field) after 10s, ½

$y = U_y t + \frac{1}{2}a_y t^2$

$= (0)t + \frac{1}{2}\frac{qE_y}{m}t^2$

$= \frac{1}{2}x\frac{2x10^{-6}x10^{3}}{10\ x\ 10^{-6}}x\ (10)^2$

$= 10000\ m$ ½

Net displacement

$r = \sqrt{x^2 + y^2}$

$= \sqrt{(10000)^2 + (10000)^2}$

$= 10000\sqrt{2}\ m$ ½ 3

22. de-Broglie put forward the bold hypothesis that moving particles of matter could display wave-like properties under suitable conditions. He reasoned that nature was symmetrical and that the two basic physical entities, matter and radiant energy, must have symmetrical character. If radiation shows a dual nature, so should matter. 1

$K = \frac{p^2}{2m}$ and $p = \frac{h}{\lambda}$ ½

$\therefore K = \dfrac{h^2}{2m\lambda^2}$ ½

Also $E_{photon} = \dfrac{hc}{\lambda}$ ½

$\therefore \dfrac{K}{E} = \dfrac{h}{2mc\lambda}$

$\therefore E_{photon} = \left(\dfrac{2\lambda\, mc}{h}\right)K$ ½ 3

23. $E_n = \dfrac{-13.6}{n^2} eV$ ½

For third excited state, n=4

$\therefore E_4 = \dfrac{-13.6}{16} eV = -0.85eV$

$\therefore$ KE= 0.85eV ½

and PE = 2E = -1.7eV ½

$\Delta E = E_4 - E_1 = \left[-0.85-(-13.6)\right]eV$

= 12.75 eV ½

and $\nu = \dfrac{\Delta E}{h} = \dfrac{12.75x1.6x10^{-19}}{6.63x10^{-34}} \simeq 3x10^{15} Hz$ 1 3

24. (i) The resultant intensity, at any point on the screen, is given by

$I = 4I_o \cos^2 \dfrac{\phi}{2}$

For constructive interference:

$\varphi = 0, 2\pi, 4\pi$ and so on

For destructive interference:

$\phi = \pi,\ 3\pi,\ 5\pi$ and so on

$\Rightarrow I = 0$ for minimum intersity,

and $I = 4I_o$ for maximum intensity 1

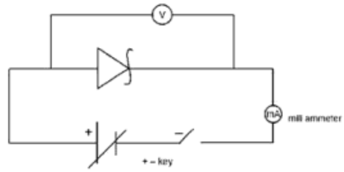
Thus, intensity varies between zero and four times the intensity, due to each slit, in Young's double slit experiment.

(ii) The interference pattern due to different colours of white light overlap incoherently. The central bright fringes for different colours are at the same position. Therefore the central fringe is white and the fringes closest, on either side of central white fringe, are red and the farthest will appear blue. After a few fringes no clear fringe pattern is seen. 1

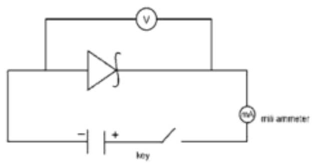
(iii) A polaroid consists of a long chain of molecules aligned in a particular direction. The electric vector (associated with the propagating light wave) along the direction of the aligned molecules get absorbed. Thus, if the light, from an ordinary source, pases through a polaroid, it is observed that its transmitted intensity gets reduced by half. 1 3

25. (i) Zener diode ½

(ii) Circuit diagram in forward bias and reverse bias

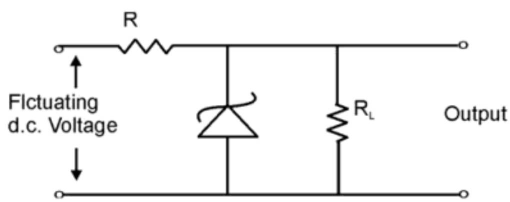


½



½

(iii)



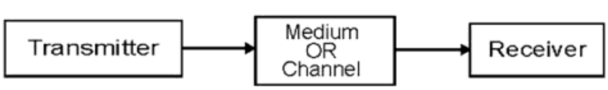
½

If the input voltage increases, the current through R and Zener diode also increases. This increases voltage drop across R without any change of voltage across the Zener diode. 1 3

26. Greater the binding energy, less is the total mass of a bounded system, such as a nucleus. Consequently, if a nucleus, with less binding energy per nucleon, transforms to nuclei with greater binding energy per nucleon, there will be a net energy release. Reaction will be exothermic. 1

For example in case of fission, when a heavy nucleus decays into two or more intermediate mass fragments or in fusion, when light nuclei fuse into a heavier single nucleus, energy is released 2 3

27.



1

Two basic modes of transmission are (i) point-to-point and

(ii) broad cast mode. $\frac{1}{2}+\frac{1}{2}$

Point-to-point mode is used for Telephonic communication. 1 3

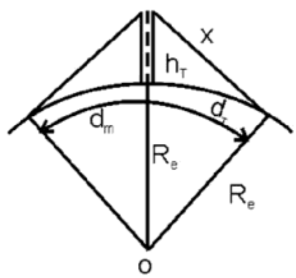
OR

No, it is not necessary to have the same height. ½

For transmitting antenna of height h_T , $(h_T+R_e)^2 = x^2 + Re^2$

$\because$ $h_r << Re$ $\therefore$ $x = d_T$

or



$(h_T + R_e)^2 = d_T^2 + R_e^2$ ½

$h_T{}^2 + R_e{}^2 + 2h_TR_e = d_T^2 + R_e^2$

(h_T^2 is negligible) ½

$\Rightarrow d_T = \sqrt{2R_e\, h_T}$

d_T is also called the radio horizon of the transmiting antenna. ½

The maximum line-of-sight distance d_m between the two antennae is

$d_m = \sqrt{2R_eh_T} + \sqrt{2R_eh_R}$ 1 3

where h_R is the height of the receiving antenna.

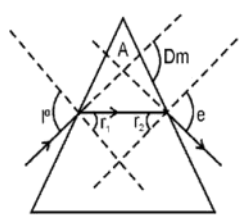
28. In general, any given value of δ, except for i = e, corresponds to two values of i and e This, in fact, is expected from the symmetry of i and e as δ = i + e -A, i.e, δ remains the same if i and e are interchanged. 1

Point P is the point of minimum deviation. This is related to the fact that the path of the ray, as shown in figure, can be traced back, resulting in the same angle of deviation. At the minimum deviation D_m, the refracted ray inside the prism becomes parallel to the base. 1

For $\delta = D_m$, $i = e \Rightarrow r_1 = r_2$

or $2r = A$ or $r = A/2$

In the same way 1



$D_m = 2i - A$ or $i = \dfrac{A+D_m}{2}$ 1

$\therefore$ The refractive index of the material of the prism is

$\mu = \dfrac{\sin (A+D_m)/2}{\sin A/2}$ 1 5

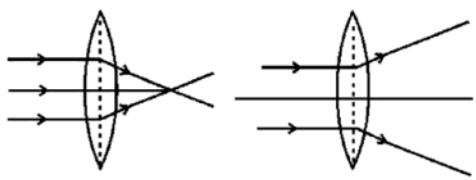
OR

Derivation of

$\Delta f = \dfrac{R_1 R_2}{R_2 - R_1}\left[\dfrac{n}{\mu - n} - \dfrac{1}{(\mu - 1)}\right]$ 2

Proof of

$f_w = \dfrac{\mu_w(\mu_g - l)}{\mu_g - \mu_w} f_w$ 1



For n<μ Convex lens

For n >μ diverging lens

1

1 5

Explanation

29. Arrangment (a): because leakage of flux is minimum (almost zero.) 1

For an ideal transformer

Input power = output power

$\Rightarrow \dfrac{E_S}{E_P} = \dfrac{I_P}{I_S}$

$\therefore$ when E_S increases, I_S decrease in the same ratio 2

Any two (correct) causes 2 5

OR

(a) Yes, $V = V_L + V_C + V_R$ for instantaneous values

It is not true for r.m.s values. For r.m.s value $V = \sqrt{(V_L \sim V_C)^2 + V_R^2}$

This is due to phase relations between the different voltages. 2

(b) Proof of : $P_{AV} = E_{rms}\, I_{rms} \cos\phi$ 3 5

30. Yes, current density is a vector quantity ½

$\therefore \quad I = neAV_d$

$\therefore \quad$ Current density ½

$$\frac{I}{A} = neV_d = ne\frac{eE}{m}\tau$$ 1

or

$$J = \frac{ne^2V}{ml}.\tau = \left(\frac{ne^2\tau}{m}\right)\frac{V}{\ell}$$ 1

(a) increases

(b) decreases

(c) decreases

(d) remains same ½ x 4 = 2 5

OR

The balance condition is–

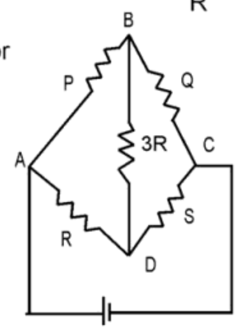
$P/Q = R/S$ or $P/R = Q/S$ ½

In the given Wheatstone bridge, we have, for balance, $\frac{2R}{R} = \frac{2R}{S}$ ½

$\therefore R = S =$ resistance of carbon resistor

$= 22x10^3\Omega$

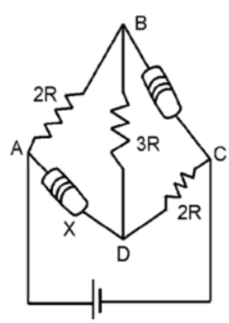
$= 22\ k\ \Omega$ 1



When the resistances are intercharged, the bridge will be a balanced one if

$$\frac{2R}{X} = \frac{22x10^3}{2x22x10^3} = \frac{1}{2}$$

$\therefore X = 4R = 88k\Omega$ ½



$\therefore$ The sequence of colours will be grey, grey and orange. 1

Also equivalent resistance, of the balanced wheatstone bridge, is given by

$$\frac{1}{R_{eq}} = \frac{1}{3R} + \frac{1}{6R} = \frac{2+1}{6R}$$

$\therefore R_{eq} = 2R$ ½

$\therefore$ Current through the (new) carbon resistor $= \frac{1}{3} \times \frac{V}{2R}$

$= \frac{V}{6R}$ 1 5