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)**

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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.

$c = 3x10^8 m/s$

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

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

$\mu_o = 4\pi x10^{-7} Tm\ A^{-1}$

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

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?

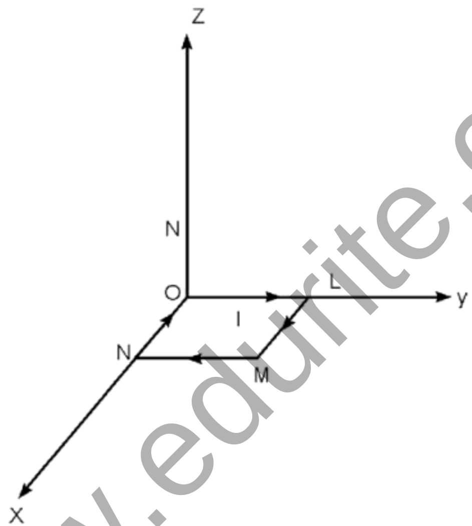
2. How will the intensity of maxima and minima, in the Young's double slit experiment change, if one of the two slits is covered by a transparent paper which transmits only half of the light intensity?

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

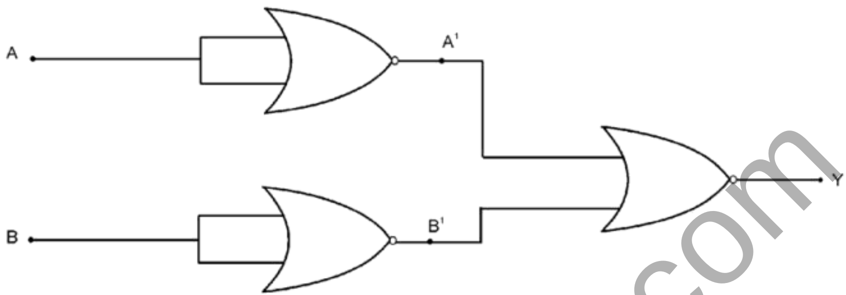
(b) Remote Sensing

(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?

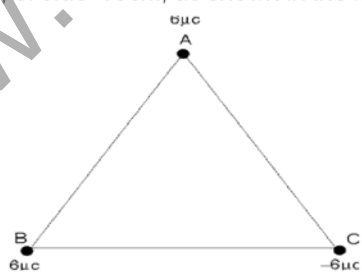
11. Calculate the half life period of a radioactive substance if its activity drops to $\frac{1}{16}$ th of its initial value in 30 years.

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.

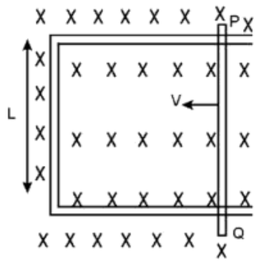


14. Write the relation for current sensitivity and voltage sensitivity of a moving coil galvanometer. Using these relations, explain the fact that increasing the current sensitivity may not necessary increase the voltage sensitivity.

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 $4 cm^2$ 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.

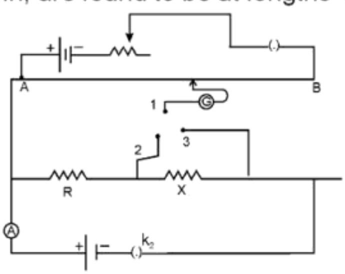
Between two successive collisions each free electron acquires a velocity from o to V where $V = \frac{eE}{m}\tau$. What is the average velocity of a free electron in the presence of an electric field? Do all electrons have the same average velocity?

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

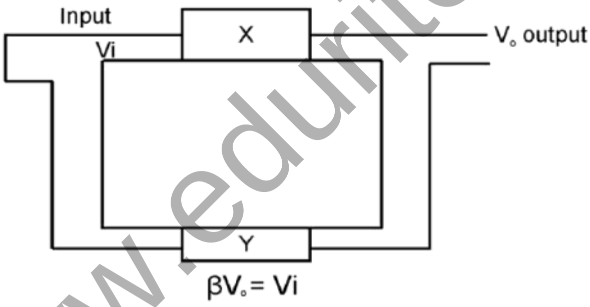
Find the expression for the capacitance of a parallel plate capacitor of area A and plate separation d if (i) a dielectric slab of thickness t, and (ii) a metallic slab of thickness t, where (t<d) are introduced one by one between the plates of the capacitor. In which case would the capacitance be more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



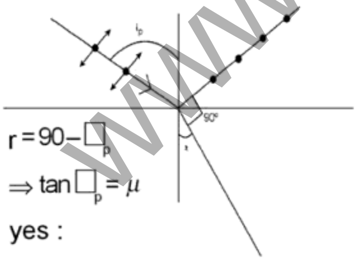
OR

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	
	$r = 90 - □_p$	½	
	$\Rightarrow \tan □_p = \mu$	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

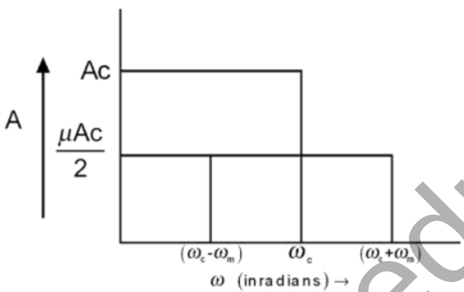
17. $\phi = \vec{B}.\vec{A} = \mu_\circ nIA$ ½

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

Substituting values, we get

$E = 50.24\text{x}10^{-5}\,V$ 1

18. 1



1

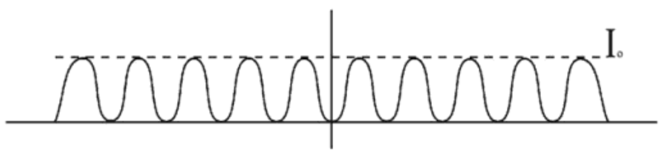
When the broadcast frequencies are spaced out, the different stations can operate without interference. 1

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

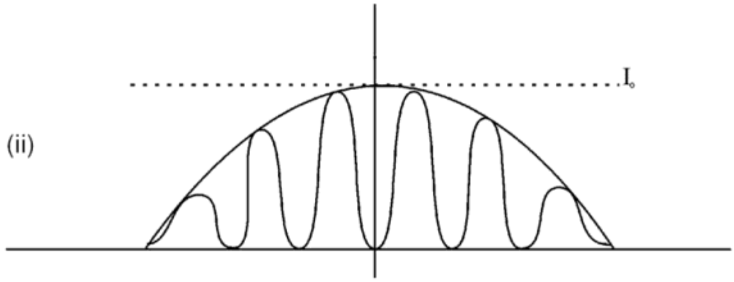
The number of interference fringes depends upon the ratio of the distance between the two slits to the width of a slit.

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

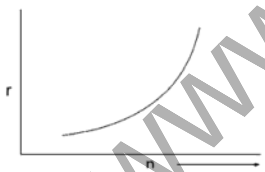
Relation $h\vartheta = \phi_{\circ} + \frac{1}{2}mV^2 \max$

$\Rightarrow h\vartheta_{\circ} = \phi_{\circ}$ 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

$r = \frac{n^2h^2\varepsilon_o}{\pi mZe^2}$ 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

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

for large x,

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

$$\frac{W}{\ell} = \frac{F}{\ell} = \frac{\mu_0 i_1 i_2}{2\pi r}$$ 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

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

$\omega = \dfrac{1}{\sqrt{LC}}$ ½

$\Rightarrow$ LCR circuit is in resonance.

$i_{rms} = \dfrac{V_{eff}}{R}$ ½

Pav = $V_{rms}\ i_{rms}$ ½ 3

V^2_{rms}/R

27. $Rx0.1 = k\ell_1$ and $\dfrac{R}{R+X} = \dfrac{\ell_1}{\ell_2}$ 1

Solving we get

Value of R	=	10 Ω	1	
Value of X	=	15 Ω	1	3

28. Derivation $\vec{E} = \dfrac{K\,\overline{P}}{(r^2 + a^2)^{3/2}}$ 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